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ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR SELECTED SEGMENTS OF THE SEAFOOD PROCESSING INDUSTRY. (CATFISH, CRAB, SHRIMP AND TUNA)

Development Planning and Research Associates,
Incorporated

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Development Planning and Research Associates, Inc.
P. O. Box 727, 200 Research Drive
Manhattan, Kansas 66502

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The economic impacts of proposed effluent guidelines on the seafoods processing industry are assessed. The analysis is confined to tuna, shrimp, crab and farm-reared catfish processing plants and includes classification and description of types of firms and plants, financial profiles, investment and operating costs and profits for selected types of model plants, evaluation of pricing relationships and analytical procedures. The financial impact of proposed effluent treatment technology was assessed in terms of prices, industry returns, volume of production, community impacts and international trade.

It is estimated that BPT waste water treatment standards will not significantly impact the tuna, crab, shrimp or catfish segments of the seafood processing industry. The impacts associated with BAT standards is more serious but received only limited emphasis in the report.

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(Catfish, Crab, Shrimp and Tuna)

David L. Jordening

July, 1974

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PREFACE

The attached document is a contractor's study prepared with the supervision and review of the Office of Planning and Evaluation of the U. S. Environmental Protection Agency (EPA). Its purpose is to provide a basis for evaluating the potential economic impact of effluent limitations guidelines and standards of performance established by EPA pursuant to sections 304(b) and 306 of the Federal Water Pollution Control Act.

The study supplements an EPA technical "Development Document" issued in conjunction with the promulgation of guidelines and standards for point sources within this industry category. The Development Document surveys existing and potential waste treatment and control methods and technologies within this category and presents the investment and operating costs associated with various control technologies. This study supplements that analysis by estimating the broader economic effects (including product price increases, continued viability of affected plants, employment, industry growth and foreign trade) of the required application of certain of these control technologies.

This study has been submitted in fulfillment of Contract No. 68-01-1533, Task No. 18 by Development Planning and Research Associates, Inc. Work was completed as of May, 1974. The study is based primarily upon an earlier study, also prepared by Development Planning and Research Associates, Inc., entitled "Economic Analysis of Proposed Effluent Guidelines for the Seafoods Industry." The earlier report was circulated in conjunction with the publication of the Federal Register of a notice of proposed rulemaking under sections 304(b) and 306 for the subject point source category. The analysis contained in the original study has been updated based upon information received during the period of time between publication of the notice of proposed rulemaking and the promulgation of the final regulation. Because of the constraints of time, the control and treatment costs analyzed in this study may not in all instances be identical to those associated with the requirements of the promulgated regulation. However, those differences, when they exist, are minor insofar as the final conclusions of the study are concerned.

This report represents the conclusions of the contractor. It has been reviewed by the Office of Planning and Evaluation and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency. The study has been considered, together with the Development Document, information received in the form of public comments on the proposed regulation, and other materials in the establishment of final effluent limitations, guidelines and standards of performance.

ECONOMIC ANALYSIS OF EFFLUENT LIMITATION GUIDELINES FOR SELECTED SEGMENTS OF THE SEAFOOD PROCESSING INDUSTRY

I. INDUSTRY SEGMENTS

A. Scope

This report is limited to consideration of the economic impact of proposed effluent limitation guidelines for selected portions of the seafood processing industry. This includes selected segments of the following seafood species: tuna, shrimp, crab and catfish.

These seafood processors are included in two SIC codes:

SIC 2091 -- Canned and Cured Seafoods --

Establishments primarily engaged in cooking, canning or processing fish, shrimps, oysters, clams, crabs and other seafoods.

SIC 2092 -- Fresh or Frozen Packaged Fish and Seafoods --

Establishments primarily engaged in preparing fresh and raw or cooked frozen packaged fish and other seafood.

It should be noted that the above species constitute only a portion of SIC 2091 and 2092.

The analysis contained in this report will be applicable to only a portion of all tuna, shrimp, crab and catfish processors. Producers of specialty items or those plants that are primarily reprocessors will not be included in the analysis. Secondly, this report will concentrate on only those plants that are principally engaged in the production of the above species. That is, we will consider only those plants where the value of shrimp, crab, tuna or catfish products constitutes greater than 80 percent of the total value of all products produced by the plant.

The last limitation is necessary in that effluent treatment cost data are not available on a multispecie basis and the use of the 80 percent criteria reduces difficulties associated with applying single specie effluent treatment cost data. All plant numbers and projected impacts will therefore apply to only a portion of the total industry.

The objective of this report is to assess the economic impact of effluent guidelines on selected segments of the seafood processing industry subject to the limitations outlined above. Selecting the waste water treatment strategy, assessing capital and operating costs associated with recommended treatment strategies, and evaluating the effectiveness of the proposed strategy is included in the objectives of other studies. Likewise, other topics with obvious merit, such as the optimal regional waste treatment strategy or the economic benefits of water quality enhancement in general are beyond the contractual scope of this report.

This report will therefore consider only the economic impact of impending guidelines on selected portions of the seafood processing industry--based on one recommended "end of pipe" treatment strategy and associated cost as provided by EPA. Since these costs, i.e., "end of pipe" treatment costs, do not include the costs of treating liquid wastes discharged into municipal treatment systems, we shall be concerned only with nonsewered plants.

B. Order of Presentation

The remainder of this report is concerned with the following topics.

Selected industry characteristics are discussed in Chapter II.

Financial characteristics -- general and specific -- will be presented in Chapter III.

The impact methodology is developed in Chapter IV.

All effluent treatment costs are presented in Chapter V.

The impact analysis is developed and summarized in Chapter VI.

The limits of the analysis are discussed in Chapter VII.

II. INDUSTRY CHARACTERISTICS

A. Number of Plants

There are approximately eighteen hundred seafood processors located in the United States. This includes tuna processing plants located in Puerto Rico and American Samoa. Plant numbers were developed from lists of the National Marine Fisheries Service (NMFS) except for Alaska. NMFS does not compile plant list data for Alaska and the list of plants for that state (200+) was developed from information from the Alaskan Game and Fish Commission and other sources.

Seafood processing plants are located on all coasts and virtually every coastal state. Since, however, the emphasis of this report is on primary seafood processors that depend on fresh raw product, the geographical area of consideration is a relatively narrow band of land contiguous to all coastal areas. The obvious exception is that of catfish processors who depend on pond-reared or river caught catfish and are therefore not confined to seacoast states.

The SIC classification presented earlier suggests delineating plants on the basis of type of processing, i.e., canning, freezing, fresh or cured. This taxonomy has been abandoned in this report in that the plant lists utilized do not contain detailed data concerning volume by type of process. This limitation is not viewed as a serious omission in that many plants within the industry engage in all type of product preparation, e.g., canning, freezing, fresh and cured.

The plant numbers presented below were developed from NMFS data and includes only primary processors and plants meeting the specialization criteria briefly discussed above. In addition, the plant numbers presented below do not include the producers of speciality items but reflect only primary production and producers.

1. Number of Catfish Processors

Catfish freezers account for 99+ percent of the total volume of processing in this industry segment. There is essentially no production of canned catfish and only a negligible quantity is smoked or otherwise cured. Frozen catfish production is primarily confined to processing of pond-reared catfish.

Pond-reared catfish are produced and processed principally in the Southern States. Major states, in terms of numbers of freezers, in 1972 include Texas, Alabama, Mississippi, Arkansas and Louisiana.

Virtually all of the catfish processing operations are operated in conjunction with production enterprises but also process fish from other producers in the area. Most firms are relatively small single plant organizations.

Many catfish processors also handle other species including products produced from carp, shrimp, eel, oyster, blue crab as well as other species.

There were a total of 40 catfish processors operating in the U.S. in 1972.[1] In addition, there were several other processors that were classified as specialty producers or reprocessors.

Considering only those plants where the value of catfish production constituted greater than 80 percent of the total value of plant production reduces the number of plants included herein to 31. The largest plants within this group includes several plants with sales of approximately $2 million. At the other end of the size spectrum there are a number of plants with sales of $20,000 or less. Additional data reviewed by DPRA indicates that there are additional small plants scattered throughout Southern states that have not been included on the basic plant lists utilized. In general, the plants that have been omitted tend to be very small "back yard" operations that are not viable entities in and of themselves.

2. Number of Crab Processors

Blue, Dungeness, King, Tanner and a limited number of Rock Crab processors are included in the crab processing segment. The inclusion of these species again means that plants located on all coastal areas of the U.S. must be considered.

Crab is sold fresh, frozen, canned, sectioned and whole. The type of product varies by specie, and by geographic area as influenced by consumer preference or consumer demand.

The number of plants engaged in the processing of these products are as follows:

Type/area	Number of Plants[2]
Blue crab (Atlantic and Gulf Coast states)	152
Dungeness Crab (West Coast & Alaska)	9

---

[1] NMFS Plant List

[2] Ibid.

The number of plants listed reflects only those plants that fall in the greater than 80 percent production and specialization category as outlined above.

In addition, to the above plants there are 59 crab plants operating in Alaskan crab fishery. The last group of plants, i.e., Alaskan crab processors, have not been delineated on the above mentioned 80 percent criteria. In actuality many of the 59 Alaskan crab plants are primarily salmon, groundfish or shellfish processing plants. In fact, data reviewed indicates that only 4 of the above 59 plants are exclusive crab processing plants. In addition, it is also believed that some of the plants included in this list are actually wholesalers that simply purchase raw product caught in the area for further processing elsewhere.

3. Number of Shrimp Processors

The shrimp segment has been subdivided into the following subsections:

Northern Shrimp
(West Coast & New England States)

Southern Shrimp

Breaded Shrimp

Combination Shrimp
(Breaded and Southern)

Alaskan Shrimp

The number of plants in these segments are again net -- considering only primary producers and further subject to the above mentioned 80 percent specialization criteria. This does not, however, hold for the combination shrimp segment which includes those plants where breaded and southern shrimp constitutes greater than 80 percent total plant production -- again based on value of sales. The other exception is that of Alaska which has not been delineated on the 80 percent criteria.

The number of plants in the above segments are as follows:

Shrimp Segments	Number of Plants
Southern Shrimp	85
Northern Shrimp	19
Breaded Shrimp	11
Combination Shrimp	15
Alaskan Shrimp	30

Of the 30 Alaskan shrimp plants reported, only 3 are classified as being primarily shrimp plants. The remainder are principally salmon, groundfish or crab processing plants.

4. Number of Tuna Processing Plants

In general, the canning of tuna is carried out in large-scale, semi-specialized plants that process tuna, tuna-like fishes or related products. Although most tuna is canned in multi-product fish canneries, there is considerable specialization. The production of canned tuna accounts for greater than 80 percent of the total value of plant production in approximately two-thirds of all plants that produce canned tuna.

The industry is dominated by five large canners:

Bumble Bee Seafoods Division of Castle and Cook, Inc.
Del Monte Corporation
Starkist Foods Inc., a division of the Heinz Company
Van Camp Sea Foods Co., a division of the Ralston Purina Company
Westgate-California Tuna Packers Co., a division of the Westgate-California Corporation

These five firms operate a total of 14 plants and account for over 90 percent of the total pack. All are either divisions of conglomerates, diversified corporations or large diversified food processors.

Two medium-sized canners are:

Whitney-Fidalgo Seafoods Inc. (Seattle) which is primarily a salmon canner, but canned tuna which accounted for 12 percent of its total sales in 1972.[1]

IBEC (International Basic Economy Corporation) is a diversified development-investment New York corporation with substantial business interest in Latin America, which operates a tuna plant in Puerto Rico.

The other packers are small relative to the above plants or are parts of diversified fish canning or custom canning firms.

In the case of tuna, the specialization criteria that was adopted was again 80 percent. On this basis there are 16 plants included in the analysis.

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[1] 1972 Annual Report, Whitney-Fidalgo Seafoods, Inc.

5. Number of Alaskan Crab and Shrimp Processors

The list of Alaskan seafood processors was constructed from publications by the state of Alaska, National Canners Association and personal interviews.[1] The number of plants engaged in the processing of shrimp and crabs in Alaska is as follows:

Alaskan Seafood Processors

Segment	Number of Plants
Alaskan Shrimp	30
Alaskan Crab	59

The above Alaskan numbers include all plants that reportedly processed crab or shrimp in 1972. Many of these plants processed only a small amount of crab or shrimp relative to the production of salmon.

Any plant that reported crab or shrimp production in 1972 has been included as a shrimp or crab plant. Some of the "processors" are more analogous to wholesalers rather than true processors in that very little processing or product transformation is performed by some of these operators. This is especially true of some of the Alaskan crab "processors" who essentially purchase Alaskan crab from local fishermen for further processing on the West Coast.

6. Total Number of Plants Considered

The total number of plants considered in this report by specie segment is presented below:

Segment	Number of Plants
Catfish	31
Blue Crab	152
West Coast Dungeness	9
Southern Shrimp	85
Northern Shrimp	19
Breaded Shrimp	11
Combination Shrimp (Southern and Breaded)	15
Tuna	16
Alaskan Crab	59
Alaskan Shrimp	30

---

[1] State of Alaska, Commercial Operations, 1972, Statistical Leaflet 24 and National Canners Association, Seafood Canning Waste Study.

All of the above plant numbers reflect the previously stated specialization conditions with the exception of the Alaskan segments. It should be noted that on the basis of plant numbers, the 427 plants listed above constitutes less than 30 percent on the basis of number of plants of the entire seafood processing industry.

B. Concentration in the Fisheries Industry

No regularly published data are available which permits an accurate evaluation of concentration ratios by specific product groups (tuna, shrimp, crab, catfish). General industry data for the canning and freezing of seafoods products from the 1967 Census of Manufactures indicates the following:

	Percent of total industry sales			
Product line	4 largest companies	8 largest companies	20 largest companies	50 largest companies
Canned and cured seafood	44	59	73	85
Fresh or frozen packaged fish	26	38	56	72

These data tend to indicate that there is more production concentration in the seafood processing industry than actually exists. Some of the larger segments with some concentration, e.g., canned tuna and canned salmon, tend to bias the overall concentration ratios upward. Almost all segments that we are concerned with in this report have very minimal production concentration. For the specific segments considered in this report (tuna, shrimp, crab and catfish processing) production concentration is as follows:

Tuna processing - the industry is dominated by five large firms which together account for over 90 percent of the total pack.

Shrimp processing - the industry is made up of a large number of small processors, some of which are associated with large national seafoods processors, but there is no significant degree of production concentration in the industry segment.

Crab processing - the situation is similar to that existing in shrimp processing. Less production concentration is evident in the blue crab industry than, for example, in the Alaskan Crab segment. In both segments, however, there is an increasing number of multiplant firms as well as a growing importance of large plants within the industry.

Catfish processing - the industry is small, scattered and quite fragmented. Gold Kist, Con Agra and Southern Catfish Processors, Inc. are relatively large firms but in general a significant degree of concentration does not exist in this industry segment.

Additional data developed by NMFS from plant lists can assist in further illuminating the question of concentration in the fisheries industry. This data reinforces the four summary statements present above and further portrays the general fragmented nature of the industry. This data is presented in Tables II-1 and II-2.

Table II-1 presents a more detailed summary of concentration in the fish and shellfish processing industry on a plant basis rather than on an ownership basis as is done in the census data. Considerably less concentration is shown when viewed in this manner. (Since most companies are single plant firms, concentration ratios on the basis of ownership would be quite similar.)

C. Level of Integration

Integration within the fisheries industry varies by product. Horizontal integration is most common. Examples of vertical integration also exist.

1. Tuna Processors

Ownership in the tuna industry is dominated by large firms, mainly conglomerates and diversified food processors. Ownership structure of this industry was briefly described on page II-4 of this report.

Table II-1. Concentration of fish and shellfish processing, 1972

Plants[1]			Value [2]	Percent of Total
			($1,000)	
4	largest	plants	354,457	16.8
8	"	"	511,097	24.3
10	"	"	582,128	27.6
20	"	"	850,548	40.4
30	"	"	1,028,340	48.8
40	"	"	1,158,258	55.0
50	"	"	1,254,354	59.6
60	"	"	1,329,898	63.2
70	"	"	1,393,757	66.2
80	"	"	1,447,774	68.8
90	"	"	1,496,381	71.1
100	"	"	1,538,204	73.1
125	"	"	1,615,279	76.7
150	"	"	1,675,015	79.6
175	"	"	1,725,680	82.0
200	"	"	1,769,109	84.0
Total all plants				
1,589[3]			2,105,290	100.0

[1] Ranking is by individual plant rather than by companies.

[2] F.O.B. Plant.

[3] Does not include Alaska.

Source: National Marine Fisheries Service.

Table II-2. Number and size of U. S. seafood processing plants, 1970 and 1972 [1]

Size Class	1970		1972	
	No. of Plants	Precent of Total	No. of Plants	Percent of Total
Up to $25,000 [2]	414	24.8	309	19.4
$25,000 to $99,999	401	24.0	364	22.9
$100,000 to $199,999	233	13.9	232	14.6
$200,000 to $299,999	128	7.7	144	9.2
$300,000 to $399,999	81	4.8	65	4.1
$400,000 to $499,999	45	2.7	61	3.8
$500,000 to $749,999	76	4.5	91	5.7
$750,000 to $999,999	53	3.2	54	3.4
$1,000,000 to $1,499,999	65	3.9	54	3.4
$1,500,000 to $2,499,999	65	3.9	81	5.1
$2,500,000 to $4,999,999	46	2.8	52	3.3
$5,000,000 to $9,999,999	34	2.0	39	2.4
$10,000,000 and over	31	1.8	43	2.7
Totals	1,672	100.0	1,589	100.0

[1] Does not include Alaska.

[2] Dollar values are F.O.B. plant.

Source: National Marine Fisheries Service.

Horizontal integration exists in that five of the major tuna packers operate multiple plants. In addition, while tuna packing is the primary function of the plants with which this report is concerned, other species of fish and shellfish (salmon, crab, shrimp, etc.) are also processed by many of these tuna packers, either in the same location or in plants at other locations owned by these firms. Two of the major firms (Del Monte and Heinz are diversified food processors. Three, Bumble Bee (Castle and Cook), Westgate California Tuna Packers (Westgate California Corporation) and IBEC (International Basic Economy Corporation) are parts of conglomerates and one (Van Camp Sea Foods, Co.) is a division of a major feed manufacturer (Ralston Purina). Others such as Whitney-Fidalgo or Lazio are diversified (salmon, tuna, crab, shrimp) seafoods processors.

The tuna packers are often vertically integrated backward to a degree in that, some processors either operate tuna fleets directly, through subsidiaries or exercise a degree of control over suppliers through delivery contracts or financing arrangements. Several plants also have pet food packing facilities and reduction plants operating in conjunction with their basic tuna canning operations.

2. Shrimp Processors

There is little integration in the shrimp processing industry. Almost all processors -- either canners or freezers are single-plant firms. However, some shrimp processors are divisions of larger seafoods processing companies such as Bumble Bee, California Westgate, etc.

Many shrimp processors also process crab and, in some instances, are also processors of a wide variety of both finfish and shellfish.

Although there is some vertical integration backward, toward fishing operations through the ownership of shrimp boats and through contractual arrangements with private boat operators, such integration is not an important factor in this industry. Some processors carry integration forward in that they not only process and freeze raw and cooked shrimp but also produced breaded frozen shrimp and other prepared shrimp products.

3. Crab Processors

There is probably less integration in the blue crab processing segment than there is in the shrimp industry. Most blue crab processors are single-plant firms, however multiplant operations are becoming more important each year. In Alaska and the West Coast States, combinations of crab with shrimp processing are common and substantial crab processing is carried out by diversified fish and shellfish processors.

Gulf and Atlantic Coast blue crab processors frequently process oysters, shrimp as well as other species. More than half of the plants that process blue crab are specialized to the extent that crab products constitute greater than 80 percent of the value of all products produced by the plant.

4. Catfish Processors

Vertical integration, backward to catfish production and forward to live hauling, catfish restaurants and pay fishing lakes, is common in the catfish industry. Data were available on 22 firms and showed the following integration or production combinations.

	No. Firms
Process only	5
Process plus food fish production	5
Process plus food fish plus live hauling	8
Process plus food fish plus live hauling plus catfish restaurant	1
Process plus food fish, plus live hauling, plus restaurant, plus pay lake	1
Process plus food fish, plus live hauling plus pay lake	1
Process plus catfish restaurant	1

Single plant firms are the general rule, only a few firms operating multi-plant operations.

At one time it was thought that the catfish industry offered opportunities for integration in terms of feed supply, catfish production, processing and marketing similar to that which exists in the broiler industry. As a result, large feed-broiler firms such as Ralston Purina undertook to establish catfish operations. However, primarily as a result of marketing problems, these integrated operations were not successful and only one firm of this type (Gold Kist) remains in the catfish industry.

D. Technological Status of the Industry

1. Tuna Processing

There has been little change in tuna processing in recent years. New plants, either built or planned, will incorporate the latest developments in canning technology and effluent control, but the remainder of the plants follow conventional canning procedures which have not changed materially in recent years.

The major change affecting the tuna processing industry has been on the supply side. The securing of adequate supplies of tuna for canning is the most pressing problem facing the industry and many processors are integrated backward towards fishing operations through direct or indirect ownership of vessels or through contractual arrangements with private tuna boat operators. Improvements in the size and efficiency of tuna fishing vessels and equipment have enabled the operators to forage the seas for greater distances from the canneries where the fish are to be canned. This ability reduces the number of unsuccessful fishing trips and tends to insure the canneries of a more stable tuna supply through the year.

Some, though not substantial, improvement has occurred in the use of sophisticated equipment used to locate new fishing grounds. Further efforts to improve the methods of exploration and location of fish should be of great importance to the tuna industry, particularly as the U.S. offshore fisheries are subjected to greater fishing pressures. The tuna industry, especially the supply side, serves as an excellent example of the positive results derived from progressive leadership, management and additional investment.

2. Shrimp Processing

In the shrimp processing industry, the most important and far-reaching technological change has been the invention and adoption of the mechanical shrimp peeler. The PCA Lathrum peeler and the Model A mechanical peelers will peel 700 - 900 pounds of shrimp per hour. Mechanical peeling has resulted in substantial reductions in peeling costs, from 40 cents per pound of shrimp meat to as low as 10 cents per pound. The change to mechanical peeling is taking place at a time when the availability of shrimp peeling labor has dropped substantially, the cost of such labor has risen rapidly and the demand for shrimp has continued to increase. The development of this equipment has been a major factor in enabling the shrimp processing industry to meet the problems posed by scarce and costly labor in the face of increased demand for shrimp. This trend is particularly true for selected segments of the shrimp industry.

Recent trends on the West Coast indicate that the mechanized segment of the shrimp industry has been expanding very rapidly in recent years. The mechanized peeler is much more water intensive and consequently two problems are frequently encountered, one, securing an adequate supply of fresh water and, two, treating or disposing of this larger volume of waste water.

3. Crab Processing

Technology in crab processing has not advanced at as rapid rate as is true for shrimp. Mechanical extraction of crab meat from the shell is not as widely adopted as has been the case for shrimp. However, roller picking has become important in Alaska in spite of a somewhat lower meat yield. In other areas, hand picking is still predominant. For both crab and shrimp meat, the most significant technological-marketing change has been the expansion of frozen shellfish sales to both institutional and household users.

There are, however, indications that mechanical pickers are becoming more common even among smaller blue crab processors. In some cases smaller operators lease the machines from larger processors and in turn consign the picked meat to be marketed through the large processor.

Recent estimates indicate that a total of 21 blue crab plants have mechanized crab picking facilities. An additional five plants are planning to add mechanized facilities within the near future. Increased mechanization is expected.

State	Number of Partially Mechanized Blue Crab Plants
Maryland	2[1]
Virginia	7
North Carolina	3
South Carolina	2
Georgia	2
Florida	4
Texas	1
Total	21

Even though 21 plants are partially mechanized plants there is still substantial labor requirements within these operations. Many production steps can not at this time be duplicated by machines. During periods of limited product availability many machines remain idle and the plants revert to essentially manual or hand operations.

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[1] Estimates provided by Everett Tolley, Executive Director, Shellfish Institute of North America.

4. Catfish Processing

Industrialized processing of catfish is a relatively new industry and has emerged in its present form only within the past 6 or 7 years. Processing catfish consists of heading, gutting and skinning. Heading is ordinarily done with a bandsaw, gutting and cleaning is done by hand and skinning is either done mechanically or by hand or by a combination of machine and hand dressing. In a survey of 16 catfish processors in the South, completed by the USDA in 1970,[2] seven plants used machine skinning, seven used hand dressing only and two plants used a combination of machine and hand operations. Sizing of dressed fish is ordinarily done by sight-judgment, but one of the 16 plants had an automatic weighing-sorting machine. In its present status, many small plants within the industry are still at a relatively low-level stage of technology while larger processors are utilizing more advanced technology including many water saving innovations.

In general, however, catfish processing utilizes a greater degree of mechanization than most other seafood processors which is not surprising or unrelated to the fact that the entire industry is a relatively new development.

E. Pack - Canned and Frozen Products

1. Tuna

Nearly all tuna are canned, only negligible quantities are frozen. Distribution of the 1971 canned pack, by states, is shown in Table II-3. California is the leading state, accounting for 9.7 million cases or 43.8 percent of the total pack. Puerto Rico is the second most important tuna canning state, 7.7 million cases or 34.9 percent of the total. The importance of Puerto Rico has been increasing rapidly in recent years. Maryland, Hawaii and American Samoa together account for 14.9 percent of the total pack, Oregon 5.4 percent and Washington 1.0 percent.

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[2] Catfish Processing, A Rising Southern Industry, Agricultural Economic Report No. 224, ERS, USDA, 1972.

Table II-3. Tuna, canned pack, volume by state, 1971

State	Cases[1]	Percent of total
California	9,735,943	43.8
Oregon	1,196,123	5.4
Washington	225,994	1.0
Puerto Rico	7,744,296	34.9
Maryland, Hawaii and American Samoa (1)	3,302,617	14.9
Total, United States	22,204,973	100.0

[1] 48, 1/2-pound cans.

(1) Data unavailable by individual state or territory.

Source: Canned Fishery Products, 1971, U. S. Dept. Commerce, NMFS Current Fishery Statistics No. 5901

Table II-4. Shrimp, canned pack, volume by state, 1971

	Cases	Percent of total
Alaska (7)	966,100	30.5
Oregon (4)	63,726	2.0
Gulf States	2,136,428	67.5
Texas (1), Louisiana (12), Missippi (10)[1]		
Total, United States	3,166,254	100.0

[1] Data unavailable by individual state.

Numbers in ( ) refer to number of canning plants.

Source: Canned Fishery Products, 1971, U. S. Dept. Commerce, NMFS Current Fishery Statistics No. 5901

Table II-5. Pack of fresh and frozen shrimp, by state, 1971

Region and State	Type of Preparation						
	Raw headless	Cooked whole	Peeled raw	Peeled cooked	Breaded	Specialties	Total excluding small items
	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)
New England							
Me.	(1)	8,583	2,231	1,823	(1)	(1)	12,637
N. H.	(1)	--	--	--	--	--	(1)
Mass.	--	(1)	--	7,451	1,327	3,509	12,287
Mid Atlantic							
N. Y.	--	(1)	--	(1)	(1)	(1)	(1)
N. J.	--	--	--	--	--	(1)	(1)
Pa. & Del.	--	--	--	--	205	(1)	205
Chesapeak							
Md.	--	--	--	--	(1)	(1)	(1)
Va.	--	--	--	--	183	(1)	183
South Atlantic							
N. Car.	432	--	(1)	--	(1)	(1)	432
S. Car.	(1)	--	--	--	--	--	(1)
Ga.	2,827	--	1,186	(1)	14,236	(1)	18,249
Fla. (East Coast)	(1)	--	--	--	13,342	(1)	13,342
Gulf							
Fla. (West Coast)	6,209	--	15,357	(1)	31,531	(1)	53,097
Ala.	8,394	--	(1)	--	--	(1)	8,394
Miss.	5,562	--	(1)	--	(1)	--	5,562
La.	31,612	--	791	2,545	1,701	623	37,272
Tex.	36,083	--	12,676	(2)	23,986	--	72,745

continued.....

Table II-5. Pack of fresh and frozen shrimp, by state, 1971 (continued)

Region or State	Type of Preparation						
	Raw headless	Cooked whole	Peeled raw	Peeled cooked	Breaded	Specialties	Total excluding small items
	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)	(000 lb)
Pacific Coast							
Alaska	2,250	1,309	--	3,769	--	--	7,328
Wash.	--	--	--	(1)	--	--	(1)
Ore.	--	--	--	1,706	--	--	1,706
Calif.	(1)	--	351	1,503	9,473	401	11,728
Great Lakes	All production imported in U. S. totals.						
Mississippi R.							
Mo., Okla., Tenn., Tex., & Wis.	--	--	--	--	4,648	193	4,841
Total U. S.	94,139	9,892	34,315	20,741	104,588	16,613	280,288

(1) Included in U. S. totals.
(2) Included with Louisiana.

Source: Processed Fishery Products, Annual Summary, 1971, CFS No. 5903, NMFS, U. S. Dept. of Commerce

2. Shrimp

Canned - The Gulf States (Texas, Louisiana and Mississippi) accounted for two-thirds of the pack of canned shrimp (2.1 million cases) in 1971. Louisiana had 12 canneries, Mississippi 10 and Texas 1. Alaska, with 7 canneries packed 966 thousand cases (30.5 percent of the total) and the balance (64,000 cases or 2.0 percent) was canned in 4 Oregon canneries (Table II-4).

Fresh and Frozen - The pack of fresh (chilled) and frozen shrimp is complex not only because of the number of locations and the variety of products, but also due to the fact that plants operate with fresh, frozen and imported frozen raw materials. Table II-5 shows the distribution of the fresh and frozen shrimp pack, by state and type of end product for 1971.

Although it is difficult to calculate the absolute importance of any one state because of unreported small amounts shown, the amounts reported account for 260 out of 280 million pounds total product. On this basis, the principal freezing states are as follows:

State	Percent of total pack
Texas	26.0
Florida	23.7
Louisiana	13.3
Georgia	6.5
Maine	4.5
Massachusetts	4.4
California	4.2
Alabama	3.0
Alaska	2.6
Mississippi	2.0
Other States	9.6
	100.0

Domestic production and apparent consumption, reflecting changes in stock, imports and exports for 1947-1971 is presented in Table II-6. This table shows that imports constituted approximately 40 percent of the total supply in 1971. This trend, i.e., increasing volume of imports is very obvious in Table II-6. In 1947 imports accounted for approximately 10 percent of the total supply, 36 percent in 1957, 52 percent in 1967, 53 percent in 1970 and approximately 50 percent in 1971.

Total landings and value by region are presented in Table II-7.

3. Crab

Canned - Crab is delivered to the cannery either live, fresh meat or frozen whole sections or meat. Since a sizable portion of the product is in the form of fresh meat, crab processing is normally restricted to areas near crab fishing grounds. Three distinct production areas exist, Alaska, the Dungeness crab areas of California, Oregon and Washington and Blue crab production areas along the Atlantic and Gulf Coast States.

Data on crab are not as detailed as for shrimp, however, statistics show that of the total canned pack, blue crab accounts for 52.8 percent, dungeness crab 13 percent, king crab 24.6 percent and tanner or snow crab, 9.6 percent. Alaska is the most important crab canning state, accounting for 38 percent of the total pack (Table II-8).

Fresh and Frozen - The crab freezing industry is divided along species and geographic lines as was described for canning operations. There are four major product forms: (1) cooked meat, (2) whole cooked crab, (3) cooked sections and (4) specialty products. Differences in product type also follow geographic and specie lines.

The principal crab freezing states, 1971, are shown in Table II-9.

Supplies, utilization, imports, exports and apparent consumption for all forms of crabs are summarized in Table II-10.

In terms of total volume, blue crab is the most important specie followed by king, and dungeness (1971). Imports of crab meat constitute approximately 10 percent of total supplies. The volume of crab meat imported in 1971 was almost identical to the amount imported in 1959, which was an all time high of 7,535 thousand pounds. Between 1959 and 1971, imports dropped to a low of 2,413 thousand pounds.

F. Supply Conditions

Supply, or product availability is, in the minds of the seafoods processing industry, perhaps the greatest single problem confronting the industry today. In general, landings are extremely variable and are influenced by many factors including climatic condition, foreign competition and many other factors that can not be explained. The situation is further confused by varying national claims to offshore fishing rights (from 3 to 12 to 200 miles) which has resulted in the impounding of U. S. vessels in such countries as Peru and the recent "Icelandic Cod War" between Iceland and Great Britain. The proposed Law of the Sea Conference in 1974 will address itself to these problems but no immediate solution appears to exist.

Table II-6. Source and dispostion of shrimp (all forms) in the United States, 1947-71
(Heads-off weight)

Year	Beginning stocks1/	Landings	Imports	Total	Ending stocks1/	Exports2/	Apparent total consumption
	Million pounds						
1947	13.5	124.2	13.3	151.0	17.9	5.7	127.4
1948	17.9	110.7	21.6	150.2	16.7	3.8	129.7
1949	16.7	113.7	29.7	160.1	16.5	7.7	135.9
1950	16.5	113.9	40.2	170.6	25.7	5.0	139.9
1951	25.7	133.5	41.8	201.0	27.6	6.9	166.5
1952	27.6	135.3	38.5	201.4	15.4	6.8	179.2
1953	15.4	155.0	43.1	213.5	26.4	5.6	181.5
1954	26.4	159.7	41.5	227.6	31.2	7.5	188.9
1955	31.2	145.4	53.8	230.4	21.2	8.7	200.5
1956	21.2	133.4	68.6	223.2	21.7	7.4	194.1
1957	21.7	121.4	69.7	212.8	28.5	7.0	177.3
1958	28.5	127.3	85.4	241.2	39.2	6.8	195.2
1959	39.2	143.0	111.7	293.9	46.0	9.3	238.6
1960	46.0	148.5	119.1	313.6	51.0	11.4	251.2
1961	51.0	103.9	134.6	289.5	26.2	16.7	246.6
1962	26.2	119.1	152.5	297.8	37.9	10.8	249.1
1963	37.9	150.7	167.3	355.9	55.8	20.7	279.4
1964	55.8	133.1	169.5	358.4	45.5	23.4	289.5
1965	45.5	152.3	178.9	376.7	38.2	24.0	314.6
1966	38.2	148.2	195.0	381.4	42.5	25.5	313.5
1967	42.5	190.0	202.0	434.5	57.6	34.6	342.3
1968	57.6	184.1	209.5	451.2	55.8	29.4	366.0
1969	55.8	195.0	220.1	470.9	62.5	47.2	361.2
1970	62.5	224.6	254.7	541.8	72.2	56.6	413.0
1971	72.2	236.3	215.1	523.6	69.9	55.2	398.5

1/ Frozen only; canned not available.
2/ Includes exports of domestic and foreign-caught shrimp.

Note: To convert to approximate heads-on (live, round) weight, multiply by 1.59.
To convert to approximate edible, meat weight, multiply by 0.78.

Source: Shellfish Situation and Outlook, Market Research and Services Division, National Marine Fisheries Service, April 1972.

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Table II-7. U.S. landing of shrimp by region, 1947-71
(Round-weight)

Year	New England		Middle Atlantic[1]		South Atlantic	
	Quantity	Value	Quantity	Value	Quantity	Value
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
1947	194	11	91	45	[2]	[2]
1948	27	3	100	50	[2]	[2]
1949	10	2	90	45	[2]	[2]
1950	7	1	100	50	36,481	10,032
1951	58	10	86	48	27,771	7,382
1952	104	18	90	49	25,671	6,585
1953	38	7	86	52	32,933	9,931
1954	-	-	18	18	28,646	6,883
1955	-	-	13	13	28,539	6,939
1956	-	-	18	19	25,518	7,806
1957	-	-	28	28	28,590	9,150
1958	5	2	8	8	22,584	7,958
1959	17	5	4	4	26,006	6,527
1960	90	20	5	5	31,214	8,512
1961	68	14	6	6	19,749	6,939
1962	388	57	7	7	26,078	11,275
1963	561	67	7	7	15,529	5,246
1964	931	113	2	2	17,341	6,633
1965	2,093	245	6	6	26,191	10,160
1966	3,894	550	-	-	21,475	10,814
1967	6,991	872	-	-	20,598	9,010
1968	14,572	1,612	-	-	24,265	13,996
1969	28,272	3,478	-	-	27,306	16,186
1970	23,522	4,697	-	-	20,610	11,387
1971	24,684	4,650	-	-	30,647	20,615

Source: *Fishery Statistics of the United States,* various years
NMFS, U. S. Department of Commerce.

Table II-7. U.S. landing of shrimp by region, 1947-71 (continued)
(Round-weight)

Year	Gulf of Mexico		Pacific		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
1947	2/	2/	2,543	277	2/	2/
1948	2/	2/	3,808	296	123,525	25,450
1949	126,506	29,205	3,140	247	129,755	29,501
1950	151,753	33,112	3,232	255	191,471	43,451
1951	193,651	44,136	2,750	286	224,316	51,863
1952	198,268	48,170	3,088	280	227,221	55,103
1953	224,503	66,336	2,797	315	260,357	76,641
1954	237,153	53,652	2,517	278	268,334	60,831
1955	212,402	54,465	3,381	365	244,335	61,782
1956	193,621	62,499	5,016	570	224,173	70,894
1957	168,453	63,288	6,811	680	203,882	73,145
1958	173,354	63,871	17,891	1,091	213,842	72,930
1959	193,503	50,348	20,652	1,249	240,182	58,133
1960	205,727	57,631	12,418	764	249,452	66,932
1961	133,795	43,650	20,912	1,079	174,530	51,688
1962	141,726	60,557	22,096	1,339	191,105	73,235
1963	203,116	63,539	21,260	1,181	240,273	70,040
1964	179,032	62,695	14,497	929	211,804	70,372
1965	195,237	70,907	20,091	1,083	243,618	82,401
1966	179,230	82,973	34,438	1,956	239,037	96,293
1967	225,731	90,577	54,462	3,007	307,787	103,468
1968	204,024	95,829	56,407	3,428	299,289	114,866
1969	200,429	101,062	62,528	3,740	318,537	124,467
1970	230,474	108,186	98,859	5,484	367,469	129,758
1971	227,083	136,017	105,515	5,324	387,932	166,610

1/ May include small amounts landed in Maryland and Virginia.
2/ Not available.

Source: Fishery Statistics of the United States, various years, NMFS, U. S. Dept. of Commerce

Reproduced from best available copy.

Table II-8. Crab meat, canned pack, volume by state and species, 1971

State	Pack std. cases	Percent of total
Alaska		
Dungeness	5,291	3.8
King	33,974	24.6
Tanner	13,278	9.6
Total	52,543	38.0
California, Oregon Washington		
Dungeness[1]	12,737	9.2
Maine, N. Car., S. Car. Mississippi		
Blue[1]	73,079	52.8
Total, U. S.	138,359	100.0

[1] Data unavailable by individual state.

Source: Canned Fishery Products, 1971, U. S. Dept. Commerce, NMFS Current Fishery Statistics No. 5901.

Table II-9. Pack of fresh and frozen crab, by species, state and form, 1971

State		Dungeness				King				Tanner & Stone			Blue & Rock	
		Cooked meat	Whole cooked	Sect.	Spec.	Cooked meat	Whole cooled	Sect.	Spec.	Cooked meat	Whole cooked	Sect.	Cooked meat	Spec.
		(000 lb)												
New England -	Me.												107	
	Mass.												(1)	(1)
Mid Atlantic -	N. Y.								(1)					(1)
	N. J.													(1)
	Pa. & Del.													3,791
Chesapeake -	Md.												3,002	1,228
	Va.												3,683	237
S. Atlantic -	N. Car.												2,482	115
	S. Car.												591	
	Ga.												1,005	338
	Fla. E. Coast												1,159	(1)
Gulf -	Fla. W. Coast												1,402	521
	Ala.												322	(1)
	Miss.												498	
	La.												618	437
	Tex.												687	(1)
Pacific -	Alaska	115	1,283	948	--	9,884	24	6,266	--	1,175	11	691		
	Wash.	1,421				361				136				
	Ore.	2,080				1,220								
	Calif.	1,298	100		(1)									
Total U. S.		4,915	1,383	948	Neg.	11,465	24	6,266	Neg.	1,311	11	691	15,592	9,749

(1) Included in U. S. totals.

Source: Processed Fishery Products, Annual Summary, 1971, CFS No. 5093, NMFS, U. S. Department of Commerce

Table II-10. Supplies and utilization of king, Dungeness and tanner crabs, and crabs, all forms, in the United States, 1947-71
(Meat-weight)

Year	Supplies					
	Beginning stocks[1]	Landings King	Landings Dungeness	Landings Tanner	Sub-Total	Blue[2]
	Thousand pounds					
1947	480	151	7,591	-	7,742	21,117
1948	434	427	10,998	-	11,425	18,972
1949	450	241	8,408	-	8,649	18,542
1950	642	304	6,703	-	7,007	20,408
1951	534	399	7,040	3	7,442	18,704
1952	556	555	6,353	3	6,911	16,403
1953	382	923	6,379	17	7,319	17,589
1954	708	1,774	6,835	-	8,609	15,754
1955	658	1,663	5,840	[3]	7,473	15,676
1956	1,177	1,759	8,204	-	9,963	15,554
1957	1,620	2,615	10,266	-	12,881	18,279
1958	1,728	2,242	10,103	-	12,345	17,701
1959	1,372	3,768	8,867	-	12,635	17,930
1960	834	5,714	8,678	-	14,392	23,728
1961	1,249	8,682	7,848	2	16,532	23,479
1962	1,668	10,556	5,607	3	16,166	24,138
1963	1,781	15,748	5,967	-	21,715	21,777
1964	4,030	17,344	5,530	3	22,877	23,959
1965	6,607	26,334	6,939	-	33,273	25,729
1966	7,046	31,840	9,532	[4]	41,372	25,101
1967	4,145	25,543	10,185	28	35,756	22,311
1968	2,342	16,408	11,993	779	29,180	17,105
1969	6,674	11,546	11,533	2,690	25,769	21,004
1970	5,578	10,412	14,042	3,474	27,928	20,358[4]
1971	5,564	14,073	10,242	3,050	27,365	20,318[4]

Reproduced from best available copy.

Table II-10. Supplies and utilization of king, Dungeness and tanner crabs, and crabs, all forms, in the United States, 1947-71 (continued)
(Meat-weight)

Year	Supplies						Utilization	
							Apparent consumption	
	Other	Total	Imports	Total	Ending stocks 1/	Exports 2/	Blue crab	Crabs, all forms
	Thousand pounds							
1947	370	29,229	461	30,170	434	250	21,117	29,486
1948	199	30,596	1,388	32,418	450	73	18,972	31,895
1949	384	27,575	2,343	30,368	642	113	18,542	29,613
1950	526	27,941	4,136	32,719	534	20	20,408	32,165
1951	340	26,486	2,020	29,040	556	47	18,704	28,437
1952	227	23,541	2,167	26,264	382	33	16,403	25,849
1953	329	25,237	4,304	29,923	708	20	17,589	29,195
1954	251	24,614	3,305	28,627	658	19	15,754	27,950
1955	274	23,423	5,620	29,701	1,177	19	15,676	28,505
1956	294	25,801	5,920	32,898	1,620	17	15,554	31,261
1957	249	31,409	6,282	39,311	1,728	29	18,279	37,554
1958	300	30,346	6,026	38,100	1,372	6/	17,701	36,728
1959	330	30,895	7,535	39,802	834	6/	17,930	38,968
1960	316	38,436	5,085	44,355	1,249	6/	23,728	43,106
1961	382	40,393	4,743	46,385	1,668	6/	23,479	44,717
1962	415	40,719	4,028	46,415	1,781	6/	24,138	44,634
1963	486	43,978	5,792	51,551	4,030	6/	21,777	47,521
1964	500	47,336	4,960	56,326	6,607	6/	23,959	49,719
1965	498	59,500	4,518	70,625	7,046	6/	25,729	63,579
1966	491	66,964	2,413	76,423	4,145	6/	25,101	72,278
1967	453	58,520	2,475	65,140	2,342	6/	22,311	62,798
1968	486	46,771	6,666	55,779	6,674	638	17,105	48,467
1969	498	47,271	6,147	60,092	5,578	324	21,004	54,190
1970	947	49,233	4,552	59,363	5,564	464	20,358	53,335
1971	769	48,452	7,081	61,097	5,908 7/	180	20,318	55,009

Footnotes for Table II- 10.

1/ Frozen stocks only and not separated by species.
2/ 1947-49 landings were estimated.
3/ Less than 500 pounds.
4/ Includes live crabs soft and peelers, as in previous years. However, figures for hard and soft not separated. Conversion factor .14 used for total blue crabs in 1970-71.

5/ From 1947-57, only canned crab and crabmeat listed separately. 1958-67 no separate figures available. 1968-71 king crab exports only.
6/ Not available.
7/ Holdings as of January 31, 1972.

Note: Conversion factors: stocks to meat weight, 0.80; landings - king crab 0.20, Dungeness and tanner crab 0.24, blue crab, soft and peelers 0.55, blue crab, hard and other crabs 0.14; imports - fresh and frozen crab 0.36, crab meat 1.00; exports - fresh and frozen king crab (legs) 0.55, canned crab and crab meat 1.00. Statistics and Market News Division, National Marine Fisheries Service.

Source: Fishery Statistics of the United States, various years; Fisheries of the United States, 1971; and U.S. Department of Commerce, Bureau of the Census.

As a result of supply limitations on the domestic catch, the seafoods processing industry has been forced to turn increasingly to imported materials. However, basic processing is still done in U. S. plants. If, as a result of increased effluent control costs, returns to the U.S. processing industry are lowered so as to become unattractive, it is entirely possible that still a greater portion of U.S. seafood consumption will originate from imported fish and shellfish sources.

1. Tuna Supplies

The supply of tuna, from both U. S. landings and imports, is shown in Table II-11 and Figure II-1 for the period 1962-1972. A modest growth in U. S. landings is depicted. A sharp rise in the volume of U.S. pack originating from imported fresh and frozen tuna occurred in the early 70's. U. S. landings increased from 340.9 million pounds in 1962 to 524.4 million (a record) in 1972 -- a gain of 54 percent. However, much of this increase came from the growth of the tuna industry in Puerto Rico. Of the total 1962-72 increase of 183 million pounds, 118 million, or 64 percent, was accounted for by the growth of the Puerto Rican industry.

Imports of fresh and frozen fish for processing in the U. S. gained 400 million pounds, more than double the U. S. increase, the imports of canned tuna remaining relatively unchanged. 1972 imports of 764.8 million pounds exceeded the previous record level of 506.6 million pounds by over 50 percent.

The canned pack of tuna in 1972, 616.6 million pounds, was the largest on record, exceeding the 1971 pack, the second highest on record, by 40 percent (Table II-12). Imported raw materials (fresh and frozen tuna) accounted for 57.4 percent of the total supply of canned tuna and imports of canned tuna added 8.4 percent more, for a total of 66.2 percent (nearly two-thirds) from imported sources. It is interesting to observe that while imports of fresh and frozen tuna for processing in the U.S. have risen dramatically, imports of canned product have been relatively stable, exceeding the quota only one year (1970) since 1960 (Table II-13) primarily as a result of the doubling of the tariff rates after the quota is reached.

Table II-11. Supply of tuna, 1962-72

Year	U.S. Landings			Imports		
	Atlantic Gulf, and Pacific Coast States and Hawaii	Puerto Rico	Total	Fresh and frozen including cooked loins and discs 1/	Canned	
					In oil	In brine
			--Thousand pounds--			
1962	312,157	28,790	340,947	364,528	358	56,361
1963	321,619	37,026	358,645	320,910	224	57,270
1964	305,829	48,393	354,222	379,242	201	54,446
1965	318,895	54,576	373,471	378,637	211	50,750
1966	269,172	64,698	333,870	449,840	160	61,400
1967	328,368	97,882	426,250	387,142	186	65,135
1968	293,868	107,660	401,528	422,108	150	67,023
1969	324,884	96,268	421,152	414,453	158	72,958*
1970	*393,494	84,852 2/	478,346	464,583	153	72,109
1971	348,040	128,770 2/	476,810	506,602	1,050	58,792
1972	377,569	146,806* 2/	524,375*	764,784*	384	56,129

* Record. 1/ Round weight. Includes landings in American Samoa of foreign-caught fish. 2/ Includes a small quantity of fish landed in American Samoa by U.S. vessels.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics, 6100.

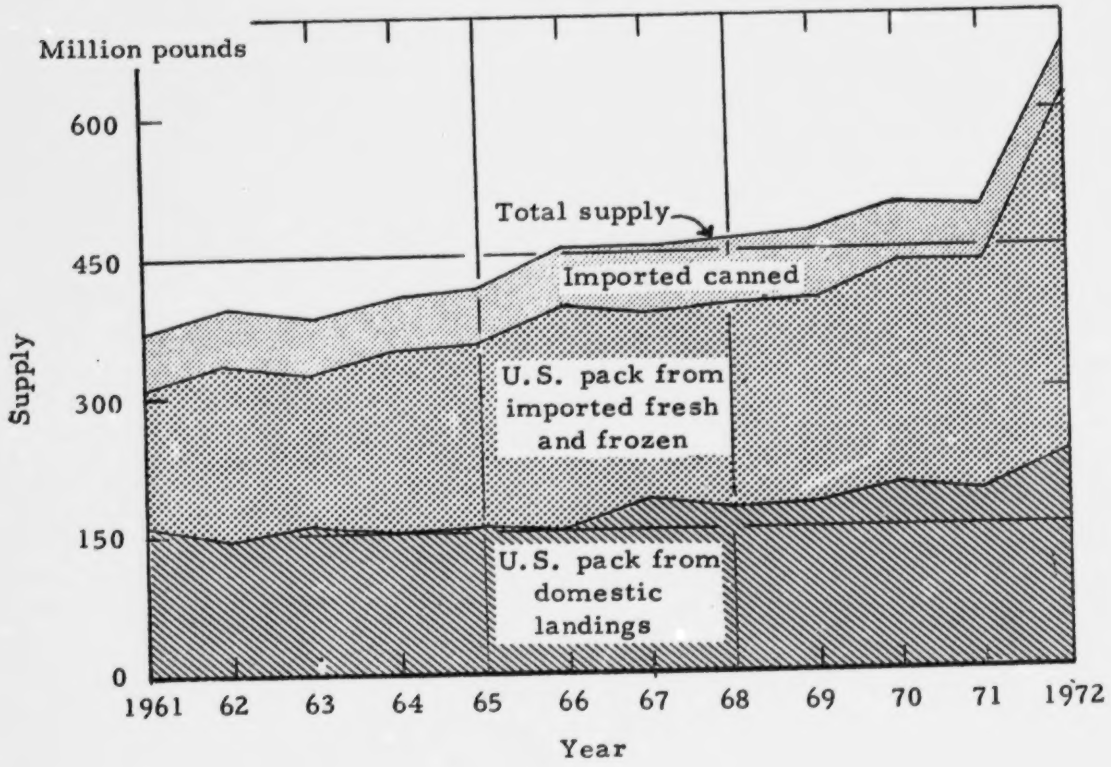

Figure II-1. Supply of tuna, 1961-1972, by source.

Table II-12. Supply of canned tuna, 1962-72

Year	U.S. pack from domestic Landings 1/		U.S. pack from imported fresh and frozen tuna 2/		Total	Imported canned		Total supply
	Thousand pounds	Percent	Thousand pounds	Percent	--Thousand pounds--		Percent	Thousand pounds
1962	147,586	37.6	187,920	47.9	335,506	56,719	14.5	392,225
1963	160,822	41.8	165,890	43.2	326,712	57,494	15.0	384,206
1964	154,208	38.1	195,626	48.4	349,834	54,647	13.5	404,481
1965	161,515	39.5	196,890	48.1	358,405	50,961	12.4	409,366
1966	153,231	33.6	241,037	52.9	394,268	61,560	13.5	455,828
1967	183,236	40.3	205,609	45.3	388,845	65,321	14.4	454,166
1968	176,524	38.1	219.433	47.4	395,957	67,173	14.5	463,130
1969	181,786	38.6	216,651	45.9	398,437	73,116*	15.5	471,553
1970	203,531	39.9	234,109	45.9	437,640	72,262	14.2	509,902
1971	194,967	39.1	243,774	48.9	438,741	59,842	12.0	498,583
1972	230,333*	34.2	386,282*	57.4	616,615*	56,513	8.4	673,128*

*Record. 1/ Includes pack from landings in Puerto Rico and American Samoa by U.S. vessels. 2/ Includes tuna canned in American Samoa from foreign-caught fish.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

2. Shrimp Supplies

The supply of shrimp has increased even greater than was true for tuna, rising from 267.6 million pounds, heads-off basis in 1960 to a record 487.5 million pounds in 1972, a gain of 82 percent. U. S. landings increased 58 percent during the 1960-72 period, but imports gained 113 percent during the same period. In 1972, over 50 percent of the total U.S. shrimp supply came from imports.

Imports by Product Form - An increasing amount of the total shrimp imports are arriving in peeled, unbreaded form (Table II-15). This category increasing from 27.4 million pounds in 1964 to 90.1 million in 1972, a gain of 229 percent compared to an increase for shell-on imports from 112.1 million pounds in 1964 to 126.8 million in 1972, a gain of 13 percent. Breaded shrimp imports, although small --1.3 million pounds -- were up 160 percent over 1964. Imports of peeled, canned shrimp remained relatively constant at about 3 million pounds. The substantial increase in peeled imports indicates than an increasing amount of total shrimp imports are being processed (peeled) in foreign countries (or on board foreign vessels) probably because of lower labor costs. Should U. S. shrimp processing costs increase as a result of water pollution controls, it is reasonable to expect this trend toward overseas processing would be further accentuated.

Shrimp Imports by County of Origin - Mexico and Central America represents the major area from which U.S. shrimp imports are drawn. In reality, an even larger proportion of the total shrimp supply comes from Latin American waters as the U.S. shrimp fleet also fishes in these areas. These countries accounted for 51 percent of U.S. shrimp imports in 1972, compared to 56 percent of our imports in 1967. However, in absolute terms, shrimp imports from Mexico and Central America increased from 104 million pounds in 1967 to 114 million in 1972 (Table II-16). Imports from South America rose from 32.5 million pounds in 1967 to 43.9 million in 1972, a gain of 35 percent and now constitute 19.7 percent of total imports. The other major source of imports is Asia and the Mid East (primarily India) where exports to the U.S. rose from 45.9 million pounds in 1967 to 60.0 million in 1972, a gain of 30.6 percent. This area now contributes 26.9 percent of the total U. S. imports. Imports from Australia and Oceania and from Africa, although small, are growing whereas imports from Europe are decreasing in response to increased demand for shrimp in Europe.

Table II-13. Quota and imports of canned tuna not in oil, 1960-72

Year	Quota [1]	Imports: Under quota [2]	Imports: Over quota [3]
	-----------------	Thousand pounds	-----------------
1960	53,448	50,322	-
1961	57,115	56,210	-
1962	59,059	54,379	-
1963	63,131	56,414	-
1964	60,912	52,931	-
1965	66,059	49,204	-
1966	65,662	57,987	-
1967	69,472	62,275	-
1968	66,985	64,907	-
1969	71,703	71,333	-
1970	70,146	70,146	902
1971	77,296	55,638	-
1972	78,532	54,449	-

[1] Imports have been subject to tariff quotas since April 14, 1956, and are based on 20 percent of the previous year's domestic pack excluding American Samoa.

[2] Dutiable in 1956-67 at 12.5 percent ad valorem; 1968, 11 percent; 1969, 10 percent; 1970, 8.5 percent; 1971, 7 percent; and in 1972, 6 percent.

[3] Dutiable in 1971 at 15 percent ad valorem; and in 1972 at 12.5 percent ad valorem.

Source: Department of the Treasury, Bureau of Customs. (Data in this table will not agree with tuna import data released by the Department of Commerce, Bureau of the Census.)

Table II-14.Supply of shrimp, 1960-1972

Year	U.S. Landings			Imports 1/			Total, heads-off
	Heads-on	Heads-off	Percent of total	Import weight	Heads-off	Percent of total	
	Thousand pounds		Percent	Thousand pounds		Percent	Thousand lbs.
1960	249,452	148,483	55.5	113,418	119,139	44.5	267,622
1961	174,530	103,865	43.6	126,268	134,564	56.4	238,429
1962	191,105	119,154	43.9	141,183	152,504	56.1	271,658
1963	240,478	150,737	47.4	151,530	167,344	52.6	318,081
1964	211,821	133,113	44.0	154,577	169,510	56.0	302.623
1965	243,645	152,346	46.0	162,942	178,955	54.0	331,301
1966	239,046	148,255	43.2	178,549	194,946	56.8	343,201
1967	307,787	189,972	48.5	186,073	202,105	51.5	392,077
1968	299,289	184,065	46.7	189,455	210,063	53.3	394,128
1969	318,537	195,002	47.1	193,741	218,697	52.9	413,699
1970	367,468	224,272	47.7	218,715	245,658	52.3	469,930
1971	*387,932	*236,328	52.5	191,295	213,857	47.5	450,185
1972	384,952	234,432	48.1	*223,226	*253,065	51.9	*487,497

1/ Imports were converted to heads-off weight on the basis of available data on the actual condition of the imports. *Record.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U. S. Dept. of Commerce, Current Fishery Statistics No. 6100.

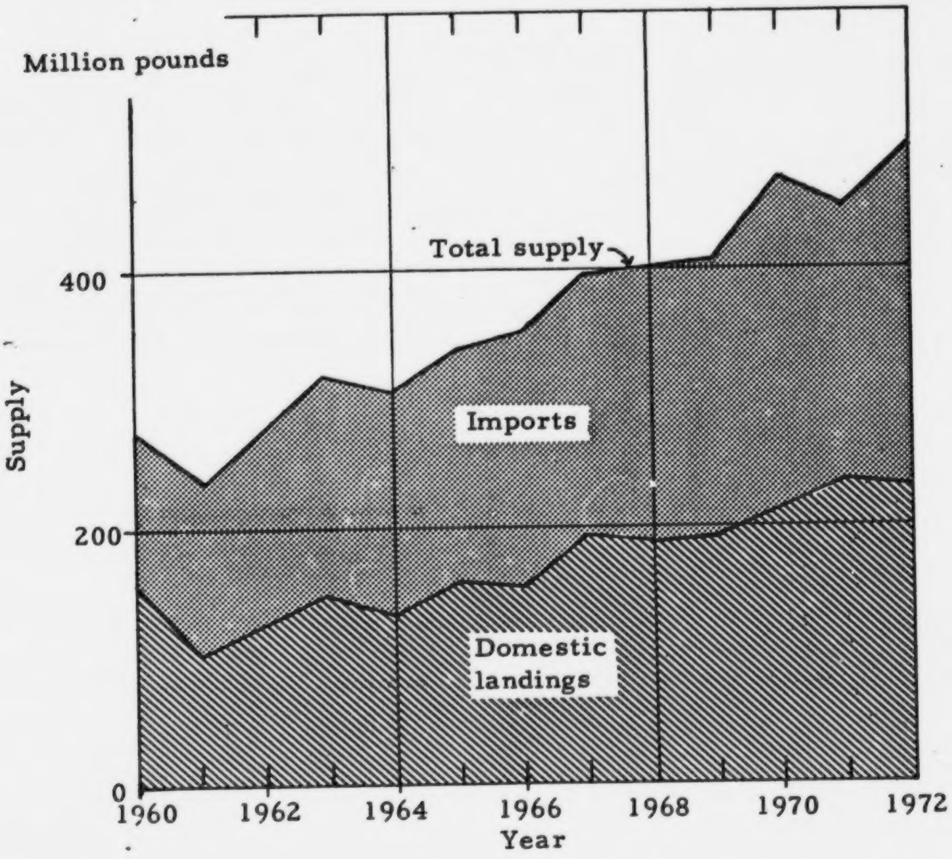

Figure II-2. Supply of shrimp, 1960-1972. (Heads-off weight)

Table II-15. Imports of shrimp, by product types

Year	Shell-on headless	Peeled canned	Not breaded Raw	Not breaded Other	Breaded	Unclassified	Total
			(thousand pounds)				
1964	112,149	3,004	27,385	2,989	508	8,542	154,577
1965	114,177	2,248	31,961	3,290	778	10,488	162,942
1966	129,919	1,547	37,233	2,565	527	6,758	178,549
1967	131,927	2,225	38,959	2,133	830	9,999	186,073
1968	128,042	4,307	47,450	1,809	1,567	6,247	189,455
1969	121,243	3,583	63,792	3,814	1,259	-	193,741
1970	139,978	3,876	69,501	3,946	1,414	-	218,715
1971	123,926	2,742	60,136	3,279	1,212	-	191,295
1972	126,771	1,123	90,143	3,866	1,323	-	223,226

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

Table II-16. Imports of shrimp, by country of origin, 1967-1972

Country	Imports - 1,000 lbs.					
	1967	1968	1969	1970	1971	1972
North America						
Mexico	70,460	59,948	56,239	72,018	74,624	80,681
Panama	11,126	10,730	9,927	11,613	9,316	10,105
Nicaragua	5,053	5,627	7,206	6,021	5,639	6,605
El Salvador	6,724	4,639	5,026	6,354	6,707	5,735
Honduras	1,922	2,981	3,925	2,626	3,942	4,811
Other countries	8,686	10,754	9,111	11,937	7,751	6,212
Total	103,971	94,679	91,434	110,569	107,979	114,149
South America						
Venezuela	4,773	5,403	5,851	11,563	10,083	7,995
Ecuador	5,986	6,289	8,901	5,992	5,332	6,935
Guyana	9,452	8,349	8,155	10,165	8,981	6,906
Brazil	2,726	3,018	3,703	4,802	4,406	8,931
Colombia	176	1,619	3,707	2,065	4,841	5,979
French Guiana	6,717	7,820	6,037	5,054	3,808	3,622
Other countries	2,623	3,856	3,993	3,937	2,616	3,515
Total	32,453	36,354	40,347	43,578	40,067	43,883
Europe (Total)	1,675	1,366	1,235	992	1,131	1,225
Asia & Mid-East						
India	18,436	22,133	34,357	33,570	22,770	33,524
Pakistan	7,457	5,475	5,409	7,125	2,924	3,978
Kuwait	-	-	-	-	2,173	2,295
Other countries	20,034	37,756	18,357	17,418	7,185	20,188
Total	45,927	54,414	58,123	58,062	35,052	59,985
Australia & Oceania	671	1,601	1,514	1,608	3,058	1,497
Africa	1,376	1,041	1,088	3,906	4,008	2,487
Grand Total	186,073	189,455	193,741	218,715	191,295	223,226

Supply of Canned Shrimp - Although the U. S. pack of canned shrimp has increased from 19 million pounds to 24 million pounds in recent years, imports of canned shrimp have decreased from 4.3 million pounds in 1968 to 1.1 million in 1972 and exports (mainly to Canada and the United Kingdom) have risen from 4.5 to 8.5 million pounds with the result that the net supply of canned shrimp available for U. S. consumption has decreased from its 1970 level and is approximately equal to the 1963 level of consumption (Table II- 17.)

Supply of Frozen Shrimp - In contrast to the relatively stable supply of canned shrimp available for U. S. consumption, the supply of frozen shrimp has increased dramatically since 1967, from 103.3 million pounds to 141.4 million in 1972, a gain of 37 percent (Table II-18). However, a substantial part of this volume is "refrozen" shrimp from imported frozen blocks of shrimp which are thawed, peeled, packaged and refrozen by U. S. freezers.

3. Crab Supplies

U. S. landings of crab have fluctuated considerably in recent years. Landings in 1972 were approximately 10 percent less than landings in 1967. This does not imply that crab is a declining resource but rather reflects periodic changes in landings due to normal fluctuations and fishing success as influenced by weather and other factors. Imports of canned crab have remained relatively steady (Table II-19). However, the composition of the crab catch is changing. Blue crab supplies have remained relatively constant, but catch of King and Dungeness crab has decreased. Tanner crab and other species such as Jonah and Red crab have come into commercial use. These changes are shown by the following data:

Species	1967 (000 lb)	1972 (000 lb)
Blue	145,027	145,356
Dungeness	42,437	26,917
King	127,716	74,010
Tanner	Neg.	28,994
Other	Neg.	5,800
Total	315,180	281,077

Table II-17. Supply of canned shrimp, 1960-72

Year	U.S. pack	Imports	Exports		Total for U.S. consumption
			Domestic	Foreign	
------	------	------	Thousand pounds	------	------
1960	14,268	(1)	3,482	34	(1)
1961	9,284	(1)	2,503	25	(1)
1962	13,249	(1)	2,212	44	(1)
1963	15,904	4,120 2/	3,199	33	16,792
1964	9,740	3,004	3,692	25	9,027
1965	15,629	2,248	4,510	34	13,333
1966	14,201	1,547	4,479	33	11,236
1967	16,851	2,225	5,255	19	13,802
1968	18,967	4,307*	4,467	20	18,787
1969	20,729	3,583	5,682	39	18,591
1970	25,125*	3,876	6,076	50	22,875*
1971	22,345	2,742	8,334	-	16,753
1972	23,795	1,123	8,450	8	16,460

1/ Data not available. 2/ Partly estimated. * Record.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

Table II-18. Freezings of shrimp and crab, 1967-1972

Year	Freezings (000 lbs.)	
	Shrimp	Crab
1967	103,322	6,566
1968	127,031	6,692
1969	128,006	4,340
1970	137,191	5,393
1971	146,691	7,659
1972	141,368	10,018

Source: Fisheries of the United States, 1972, NMFS, U. S. Department of Commerce, Current Fisheries Statistics No. 6100.

Table II-19. Supply of fresh crab and canned crab meat, 1967-1972

Year	U.S. Landings (000 lb. live wt.)	Imports of canned crab (000 lb. canned)
1967	315,180	2,160
1968	238,500	4,635
1969	246,000	3,436
1970	268,500	2,765
1971	276,374	3,723
1972	281,077	2,547

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100.

In contrast to shrimp, imports of crab for processing in the United States are negligible. Most crab are landed live and cooked immediately prior to freezing or canning and importing live crabs or partially processed crab is not practicable for some species.

U. S. Pack of Processed Crab - The composition of the U. S. pack of processed crab has changed markedly since 1966. In 1966 there was a record canned crab pack of 11 million pounds, but the canned pack has decreased steadily since that time and was only 2.4 million pounds in 1972 (Table II-20). At the same time, freezings of crab increased from 6.6 million pounds in 1967 to 10.0 million in 1972.

4. Catfish Supplies

The catfish processing industry operates primarily on pond-reared catfish produced in the Central South and the Midwest. In 1973 there were 2,217 producers producing catfish on 55,222 acres of ponds in the United States. Major producing states, in 1973, were as follows:

State	Acres
Mississippi	26,112
Arkansas	9,179
Louisiana	3,114
Alabama	2,888
Missouri	2,520
Georgia	2,446
Texas	2,280
Other States	6,683
Total	55,222

Acreage in 1971 is estimated at 43,100.

Estimated number of producers and commercial acres by state for 1973 is presented below in Table II-21.

Size of individual producing units varied from less than one acre to more than a thousand acres.

Collection of data on farm-raised catfish production began in 1967. In that year there was an estimated production of 13.7 million pounds of farm-raised catfish, compared to 38.1 million in 1971. Although the industry has grown, it is still experiencing problems concerned with processing, marketing and raw product costs.

Table II-20. Supply of canned crab meat, 1960-72

Year	U.S. pack	Percent of total supply	Imports	Percent of total supply	Total supply
	Thousand pounds	Percent	Thousand pounds	Percent	Thousand pounds
1960	4,115	47.7	4,507	52.3	8,622
1961	5,000	54.1	4,237	45.9	9,237
1962	5,621	61.6	3,505	38.4	9,126
1963	7,356	58.1	5,296	41.9	12,652
1964	6,567	59.3	4,508	40.7	11,075
1965	9,139	68.8	4,152	31.2	13,291
1966	11,002*	83.1	2,233	16.9	13,235
1967	9,707	81.8	2,160	18.2	11,867
1968	4,019	46.4	4,635	53.6	8,654
1969	5,027	59.4	3,436	40.6	8,463
1970	5,097	64.8	2,765	35.2	7,862
1971	3,213	46.3	3,723	53.7	6,936
1972	2,406	48.6	2,547	51.4	4,953

* Record. Record imports, 13,507,000 pounds in 1939.

Source: Fisheries of the United States, 1972, National Marine Fisheries Service, U.S. Department of Commerce, Current Fisheries Statistics No. 6100

Table II-21. Estimated number of commercial catfish producers and total number of commercial acres by major producing states, 1973

State	No. of Producers	Commercial Acres
Alabama	235	2,888
Arkansas	341	9,179
California	98	920
Georgia raceway	21	571
pond	43	1,875
Total	64	2,446
Illinois	14	213
Kansas	50	1,500
Louisiana	167	3,114
Mississippi	675	26,112
Missouri	140	2,520
N. Carolina	5	46
S. Carolina Pond	25 (includes 3 raceway)	478
Tennessee	125	Pond 1,381
		Raceway 211
Texas	100	2,280
Oklahoma	38	933
Other	50	500
Total	2,127	55,222

Source: USDA, Soil Conservation Service from representative states.

Data on processing volume were available only for 1970, 1971, and 1972 as follows:

Year	Processed Volume (000 lbs)
1970	3,438
1971	6,741
1972	10,977

A substantial amount of catfish is processed by small backyard, family operations and is not included in the above figures on processed volume.

Catch of wild catfish varies from 30 to 38 million pounds per year. However, virtually all of these fish are consumed fresh.

G. Employment

Employment in the seafoods processing industry has a pronounced seasonal pattern and within a processing season has intermittent ups and downs depending on the landings of fish and shellfish which determine the supply available to processors.

No published data are available which relate to employment by specific segments of the industry, i.e., tuna, shrimp, crab and catfish. Industry-wide data on employment in the seafoods processing industry are shown in Tables II-22, II-23. For seafoods products canning plants, 50 percent of the plants employ fewer than 20 people, 90 percent fewer than 100, 98 percent fewer than 250 and only one plant employed over 1,000 people. For plants processing fresh or frozen packaged fish, 52 percent employed fewer than 20 people, 92 percent fewer than 100 and no plant employed over 999.

It becomes virtually impossible to isolate "shrimp or crab" employment from other employment in many plants since these are often multi-product finfish and shellfish processors. Tuna processors tend to be more specialized, although most plants also process other species.

Table II-22. Employment, by size of establishment, canned and cured seafoods, 1967[1]

Number of employees	Number of plants
1 - 4	84
5 - 9	25
10 - 19	50
20 - 49	81
50 - 99	46
100 - 249	26
250 - 499	4
500 - 999	3
1,000 - 2,499	1

---

[1] U. S. Department of Commerce, Census of Manufactures, 1967.

Table II-23. Employment, by size of establishment, fresh or frozen packaged fish[1]

Number of employees	Number of plants
1 - 4	123
5 - 9	54
10 - 19	79
20 - 49	134
50 - 99	65
100 - 249	25
250 - 499	11
500 - 999	6

---

[1] U. S. Department of Commerce, Census of Manufactures, 1967.

Employment is highly seasonal, as related to landings of the particular species. Processing seasons will run from 100 - 250 days. As with any seasonally-produced product employment starts low, builds to a peak and then decreases as the season draws to a close. Variation in employment during the processing season may vary as much as 200 percent, or more with double shift operations common during peak periods. For most segments overtime is the most common means of handling peak processing loads.

Shrimp and crab operations employ large numbers of women as "peelers" and "pickers". Processing operations provide substantial temporary employment opportunities for minority ethnic groups and plant closures would result in severe unemployment in these groups which are not ordinarily mobile.

H. Summary

The seafood processing industry is complex in many respects. There is extreme variation in size, type, location and products handled. Numerous variations in raw product form presents additional complications.

In general, the industry is dependent on raw product availability which fluctuates greatly. Under utilization of plant capacity is the rule rather than the exception.

The industry structure varies by segment. Some segments have a few large plants that produce a significant portion of total output to other segments with literally hundreds of very small independent processors.

The volume of seafood imports is also an important consideration. The U.S. currently imports the bulk of its seafood consumption. Import capabilities varies by specie and product form. For example, more than half of the total U.S. supply of shrimp was imported. Catfish competes directly with imported groundfish and finfish fillets. Domestically produced crab products compete with foreign and domestically produced shrimp.

In summary, the seafood processing industry can be characterized as possessing many small, underutilized, old plants that in some cases compete directly with efficient, low cost foreign producers. While this generalization does not hold for the tuna processing segment, it is applicable to most of the segments considered herein.

Efficient and viable processing segments can emerge from existing segments. At the present time however, the efficient, profitable and progressive plants tend to be larger diversified processors. It is expected that this trend will continue and in fact be accentuated. It must be recognized that the bulk of the industry consists of small independent and in some cases marginal plants. In many cases these small plants are second or third generation family operations with few employment alternatives.

III. FINANCIAL RETURNS AND FINANCIAL CHARACTERISTICS OF THE INDUSTRY

The ability of industry or individual plants to withstand the financial burdens of mandatory pollution abatement standards depends on many financial, production and locational factors. These obviously include qualitative and quantitative considerations, many of which directly or indirectly reflect the financial profile of the plant. The objective of this chapter is to briefly outline some of the salient characteristics which influence the ability of industry segment or plants to either acquire capital or bear the additional operating expenses resulting from the installation or operation of waste treatment facilities.

This objective is complicated by the fact that basic investment and operating costs for the seafoods industry are not available in published form nor is such information generally available from all firms in the industry. The development of investment and operating costs for specific products, e.g. tuna, shrimp or crab, becomes particularly difficult where these products are processed as part of multi-product plant operations. In addition, some of the major processors are parts of conglomerates or diversified food processors so that analysis of financial statements given in annual reports or of data given in such publications as Standard and Poors reveals little about the costs and returns from the seafood processing operations of these corporations or specific product lines.

The situation is further complicated by the fact that the age and construction of seafoods processing plants varies greatly from plant to plant. Although the tuna processing industry is more nearly "standardized" in terms of types of plants than other segments of the industry, virtually no data on investments and operating costs are available in published form. Shrimp and crab processors operate from a variety of facilities. Some are parts of diversified seafoods processing plants, some have "floater" plants based on barges, converted ferries, obsolete "Liberty" ships or other hulls, and some operate out of shore-based plants which vary from ramshackle operations in old waterfront buildings to new, modern, specialized processing plants.

There has been very little meaningful work on the costs of processing seafoods conducted by universities or by the National Marine Fisheries Service. In its evaluation of the market research and service programs of the National Marine Fisheries Service, reported in October, 1972, Development Planning and Research Associates, Inc., recommended that priority be given to costs of processing seafoods and to economies of scale in the processing of seafoods. However, little work has been initiated in this area. An opportunity may exist for the establishment of such research by the Sea Grant funds which have been allocated to biological or physical research.

The pond catfish industry, as an extension of farming operations, has been studied to a limited extent by the U. S. Department of Agriculture and by Land Grant Agricultural Experiment Stations. However, most emphasis has been given to catfish production. In spite of this, more information on investment and processing costs and returns is available in published form for this industry segment than is true for most seafoods processing segments.

Faced with this situation, DPRA has been forced to develop its own estimates of investment and operating costs based on such data as are available from a variety of unpublished sources and on personal contacts with firms engaged in seafoods processing.

Ideally the procedure would involve a plant by plant assessment of all relevant financial and production characteristics. Clearly this is not practical due to the number of plants that must be considered herein.

It must also be recognized that the seafood processing industry is one of the most complex and diverse in terms of number of plants, size of plants, age of plants, yearly production variations, final product form and raw production variations. DPRA's first approach to the problem was to construct model plants representing groups of plants and entire industry segments. In the case of the seafood processing industry this led to some difficulties and confusion in specific line items since the models represented groups of plants. As was indicated by several reviewers, realistic models in this particular industry would almost revert to a plant by plant assessment. While this is perhaps slightly exaggerated there is a considerable element of truth in this criticism.

As a result of the above factors, together with the fact that additional data has been received from industry and government, is that DPRA has altered the methodology and will assess the impacts of pollution abatement standards in a slightly different framework of analysis.

As explained earlier we adopted a return on sales framework of analysis. The implication of the above for the current chapter is that we shall present general financial considerations and estimated profitability ranges by industry segment and the emphasis will not be on presenting detailed model plants.

A. General Considerations

As mentioned above many considerations must be evaluated to accurately determine the economic impact of impending effluent limitation standards. There are many unique factors intrinsic to the seafood processing industry that substantially and in some cases adversely influence the industry's ability to absorb or withstand the financial impacts of pollution abatement standards. Many of these characteristics are enumerated in the following subsections. Some of these items or subsections are directly related to physical or location characteristics that in turn possess financial consideration or facets. The critical nature of some of these factors is such that they must be repeated and further emphasized.

1. Physical Considerations

As mentioned above, most segments of the seafood processing industry are dominated by many small plants. This is true for all segments considered herein, with the exception of the tuna processing segment. Relatively low capital requirements have provided unrestricted entry which has resulted in a highly competitive and fragmented industry.

These plants (small economically and physically) are in general relatively old facilities that are in many cases being operated by second and third generation family members. Plant age, however, is a nebulous concept since some modernization is required and plant replacement is an on-going process. The mere fact, however, that many plants are located on sites initially established years ago has several implications.

For example, frequently the surrounding land has been developed for industrial, residential, or commercial activities, which has left the seafood processing plant enclosed and a virtual enclave. Land required for expansion or waste water treatment facilities is frequently available at only exorbitant prices. Frequently, even if land is available various constraints are encountered. These include zoning regulations or rugged terrain which is not compatible with land requirements for plant expansion or waste water treatment facilities.

2. Economic Considerations

The above general physical characteristics can be expressed in general financial or economic terms. In this case the description or narrative is couched in terms of under-utilization of plant capacity, product availability problems, difficulties acquiring required capital and declining number of small plants. For most of the seafood industry the above phrases are the general rule rather than the exception.

B. Constraints on Financing Additional Capital Assets

Constraints on financing additional capital required for water pollution control facilities will vary greatly from firm-to-firm and from location-to-location. In general, it is anticipated that there will be no serious constraints in securing capital required for pollution control for large seafoods processing plants. However, in individual situations where plants are small old and obsolete or unprofitable, and where local conditions may require substantial investments for internal pollution abatement systems or for participation in expanding capacity of sewer systems in small communities, the seafood processing owner/management may hesitate or be unable to make the investments required.

Tuna, crab and shrimp processing plants that are owned by conglomerates, large diversified food processing firms or by large diversified seafoods processing companies will have less difficulty acquiring capital and capital availability is not expected to be a limiting factor.

Capital availability may be a much more serious problem for small plants which continue to operate primarily because owners have depreciated out original investment costs, consider their investment in the plant as "sunk capital" and consider that the plant has a "utility value" if continued in operation which is greater than the "market value" or "salvage value" of the plant should they decide to cease operations. For such plants; the increased investment required for pollution control may be difficult to obtain and even if available may be unattractive to both the borrower and the lender. In these situations, the decision to attempt to obtain additional capital may be based on the desire of the owners to maintain the business for personal employment reasons rather than on the expectation of realizing a return on invested capital.

C. General Pricing Considerations

As was noted previously, under utilization of plant capacity is the rule rather than the exception. The most profitable, efficient and progressive plants tend to be large diversified processors. All of these factors have implications concerning both price effects and general pricing considerations.

Each segment tends to have a few relatively large plants. The possibility of price control or influence does not appear to exist in shrimp, catfish and crab industry segments. Most plants in these industries could accurately be labeled "price takers," due to the marginal control over raw and/or finished product prices. This inability to influence product price is due to the fragmented nature of the industry, product perishability, and under utilization of plant capacity.

Some large plants, in isolated cases, may enjoy benefits not available to the other members of the industry segment (i.e., the plant may have advantages due to diversification, closer ties with fishing fleets and/or wholesalers resulting in steadier supplies along with other pecuniary advantages). In these regional raw product markets key industry leaders appear to have limited ability in influencing raw product prices during certain periods. In most cases this influence is minor and exists for only short time periods.

It is also well to note that many old plants must compete directly with efficient, low cost foreign processing plants. This problem is accenuated by the industries' low barriers to entry, which has resulted in excess industry plant capacity (i.e., the existing number of plants exceeds the long-run equilibrium number of plants). In fact, the total industry output could be produced by fewer, larger plants efficiently operating at higher utilization rates. All of these plants in essence compete in national and in some cases world markets. It is unreasonable to believe that any one plant can substantially influence the finished product prices.

In summary, projected price effects or possible price pass through (presented later) for the tuna, shrimp, catfish and crab industries are assumed to be rather limited as a result of industry fragmentation.

D. Estimated Earnings and Financial Consideration by Segment

1. Tuna Processors

The tuna processing industry is primarily composed of firms which are, in turn, parts of conglomerates or large, diversified food canners. As such, the financial profile of the parent company or conglomerate is an important factor dictating the financial status of the tuna processor.

Earnings as a Percent of Sales - Composite industry data for the canned foods industry, which includes such firms as Heinz (Starkist), Van Camp and Del Monte -- all of which are major tuna packers -- shows before tax earnings as a percent of sales varying from 3.1 to 4.3 during the period 1965-1970, with before tax earnings in 1970 of 3.4 percent of sales. Contact with representatives of the tuna industry and review of other financial performance data on this industry, indicate that industry earnings in the seafoods processing industry are, in fact, in the area of 3-4 percent on sales. Analysis of the earnings 1967-1972 of a major, specialized seafoods processor showed average earnings of 3.5 percent on sales.

Profitability estimates developed for the tuna industry utilize a conservative figure of 1.8 percent before tax return on sales. It is believed that this estimate understates the profitability of the large plants but is representative for most of the industry including the smaller plants.

Operating Costs and Margins - Estimated costs of canning tuna are as follows: raw material costs account for 68 percent of total operating costs, labor (11.4%) and cans and cases (9.7%) being the other two major items. It is recognized that with existing plants, the degree of utilization of capacity is an important factor influencing unit costs.

Total costs are estimated to be $17.60 per case and revenue of $18.45, resulting in a gross operating margin of $.85 per case.

Earnings and Cash Flow - Model Tuna Plant - Earnings and cash flow for the model tuna plant are shown in Table III-1. These estimates were developed by DPRA from a variety of sources including published prices for fish and canned product, annual reports of firms in the industry, industry contacts, unpublished research and established financial operating ratios. In the absence of actual financial data from the tuna processing industry, they must be considered as preliminary estimates, but it is believed that they approximate conditions existing in the tuna processing industry.

Table III-1. Estimated earnings and cash flow for tuna canning plant, 1972

Item	Amount
Annual throughput (cases)	1,600,000
Sales, at $18.45 /case	$29,520,000
Operating expenses at $17.60/case	28,160,000
Cash earnings	1,360,000
Depreciation	223,750
Interest	590,400
Pre-tax income	545,850
After tax income	283,842
Annual cash flow	507,600
Replacement investment	8,950,000
Working capital	10,332,000
Average fixed assets	4,475,000
Working capital	10,332,000
Current liabilities	5,904,000
Average fixed investment	8,903,000
Pre-tax ROI (Percent)	6.1
After-tax ROI (Percent)	3.2
Pre-tax ROS (Percent)	1.8
After-tax ROS (Percent)	0.9

Annual throughput of 1.6 million cases is based on average 1971 pack for major California tuna packers. Given a price of $18.45 per case (including by-product credits) results in sales of $29,160,000 and operating expenses of $28,160,000, cash earnings of $1,680,000 result. Deducting depreciation and interest paid results in 1972 pre-tax income of $545,850 and after-tax income of $283,842. Investment, working capital and current liabilities were estimated from industry financial ratios. Pre-tax return on investment for 1972 is 6.1 percent, after-tax ROI is 3.2 and return on sales pre-tax is 1.8 percent and after tax 0.9 percent.

2. Catfish Processors

Pond-reared catfish are processed in specialized, single-product plants, usually operated in conjunction with pond-catfish production enterprises.

Catfish processing methods - Catfish are harvested by draining the ponds and are shipped alive in tank trucks to processing plants. Live hauling eliminates the need for meat preservation before processing, but generates the problem of disposal of the feces-contaminated holding water. The fish are held in live tanks until processing, which results in more feces-contaminated water.

The fish are first stunned, commonly with electric shock, and then butchered. The butchering process, which includes skinning, beheading, and eviscerating, can be either manual or mechanical. Catfish traditionally have been skinned before marketing.

Butchering machines remove only the outer layer of pigmented skin for esthetic reasons. This process results in solid wastes containing skins, heads and viscera and wastewaters containing blood, slime and flesh.

The processed fillets or steaks are marketed fresh and frozen (breaded or plain).

Earnings and Cash Flow-Model Catfish Processing Plant - The model catfish processing plant is assumed to process 1,600,000 pounds (live-weight basis) of catfish annually. This volume is based on 250 operating days, 8,000 pounds daily capacity and 60 percent of capacity. However, a survey of 16 operating plants in the South in 1970[1] reported that the 16 plants surveyed only processed an average of 400,000 lbs. per plant, 25 percent of the indicated volume. This low utilization of capacity is a problem which continues to plague the catifsh processing industry.

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[1] Catfish Processing, A Rising Southern Industry, ERS, USDA, Agr. Econ. Report 224, 1972.

Estimated costs of processing catfish are shown in Table III-2. These costs were developed by the Bureau of Commercial Fisheries and have been adjusted by DPRA to reflect current costs and prices. These costs result in a gross margin of revenue over operating costs of 2.4¢ per pound. However, it should be emphasized again that the low rate of utilization of processing capacity, which characterizes many plants in the industry, will reduce returns below the level indicated.

Annual throughput of 1,600,000 pounds is based on the survey of Southern processors and a 250-day year with an 60 percent utilization of capacity. It is recognized that 60 percent utilization may be above the current industry average.

At 60 percent utilization, with a price of 91.7 cents per pound for frozen fish, f.o.b. processor, total revenue is $1,100,000. Processing costs are estimated at 89.3 cents a pound. Gross margin is 2.4 cents per pound resulting in cash earnings of $28,000. Deducting depreciation and interest results in a pre-tax income of $1,650 and after-tax income of $858. On the basis of the above data pretax return on investment is estimated to be 1.4 percent, after tax return on investment is 0.7 percent, pretax return on sales in 0.2 percent and after tax return on sales is 0.1 percent. Due to the uncertainty currently existing in the industry and variations between plants profitability estimate of ± 1 percent before tax return on sales has been used in the analysis.

Table III-2. Estimated processing costs for frozen pond-reared catfish

Item	Cost per pound	Percent of total
Raw material (fish at plant)	$ .640	72
Labor	.095	11
Packaging material	.040	5
Building and equipment costs	.063	7
Overhead and sales cost	.055	5
Total cost	$ .893	100
F.O.B. plant revenue	.917	
Return over cost	.024	

Table III-3. Estimated earnings and cash flow for model catfish processing plant

Item	60% Capacity
Annual throughput, pounds frozen fish	1,600,000
Sales at 91.7¢ per pound	$1,100,000
Operating expenses at 89.3¢ per pound (Table II-19)	1,072,000
Cash Earnings	28,000
Depreciation	10,750
Interest	15,600
Pre-tax income	1,650
After-tax income	858
Annual cash flow	11,608
Replacement investment	215,000
Working capital	281,000
Average fixed assets	107,500
Working capital	281,000
Current liabilities	216,000
Average fixed investment	117,500
Pre-tax ROI (Percent)	1.4
After-tax ROI (Percent)	0.7
Pre-tax ROS (Percent)	0.2
After-tax ROS (Percent)	0.1

3. West Coast Crab and Shrimp Processors

Crab and shrimp are processed in both canned frozen and fresh form. Since initial preparation, up to the point of actual canning or freezing, is similar, many plants will combine canning and freezing production. A total of 9 West Coast combination crab and shrimp plants were modeled. Various product and process combinations have been included. All models were based on groups of plants and checked with reliable industry sources. While additional detail on total plant production is presented (including species not considered in this report) less detail is presented on total plant investment. These model plant data are attached at the end of this chapter.

It should be noticed that there is considerable variation in ROS for these plants. ROS for shrimp line range from -3.5 to 1.9 percent. ROS for crab lines range from approximately 10 to 20 percent. This, as has been frequently pointed out, is characteristic of the industry.

4. Gulf and Alaskan Shrimp Processors

Income, return on sales, return on investment and cash flow data for Alaskan and Gulf shrimp processors is presented below. This data is a capsulized summary of previous work. Modifications will be presented later in this chapter.

Type of plant	Size	Annual throughput (000 lb. liveweight)
1. Alaskan canned shrimp	Small	2,600
2. Alaskan canned shrimp	Medium	4,550
3. Alaskan frozen shrimp	Small	2,600
4. Alaskan frozen shrimp	Medium	4,550
5. Gulf Coast canned shrimp	Medium	3,000
6. Gulf Coast frozen shrimp	Medium	3,500
7. Gulf Coast breaded shrimp	Small	875
8. Gulf Coast breaded shrimp	Large	5,000

	Income		ROI		ROS		Cash Flow
Type & Size of Plant	Pre-tax ($000)	After-tax ($000)	Pre-tax (%)	After-tax (%)	Pre-tax (%)	After-tax (%)	-- ($000)
Alaskan, canned, small	$144	$ 75	21.4	11.2	11.9	6.2	$ 26
Alaskan, canned, medium	259	135	25.0	13.0	12.3	6.4	173
Alaskan, frozen, small	111	58	11.5	6.0	13.8	7.2	43
Alaskan, frozen, medium	206	107	14.1	7.4	14.6	7.6	171
Gulf, canned, medium	78	41	7.6	4.0	4.1	2.2	79
Gulf, frozen, medium	32	17	4.4	2.3	3.1	1.6	77
Gulf, breaded, small	9	5	3.8	1.9	3.1	1.6	15
Gulf, breaded, large	150	78	7.6	3.9	5.0	2.8	243

5. Blue Crab and Alaskan Crab Processors

A summary of income, return on sales, return on investment and cost flow data for Alaskan and blue crab processors is shown below. This data is a capsulized summary of previous work. Selected modifications in profitability ranges will be introduced in the impact analysis.

	Type of plant	Size	Annual throughput (000 lb. liveweight)
1.	Alaskan canned crab meat	Small	2,100
2.		Medium	3,750
3.	Alaskan frozen crab meat	Small	2,100
4.		Medium	3,750
5.	Blue crab canned meat	Small	2,000

Earnings for the types and sizes of plants specified were as follows:

	Type and size of plant				
	Alaskan Crab				Blue Crab
	Canned		Frozen		Canned
	Small	Medium	Small	Medium	Small
Pre-tax income ($000)	$73	$135	$132	$248	$14
After-tax income ($000)	38	70	67	129	7
Pre-tax ROI (%)	14.8	18.1	15.0	18.0	9.1
After-tax ROI (%)	7.7	9.4	7.6	9.3	4.8
Pre-tax ROS (%)	10.1	10.4	8.1	8.5	2.4
After-tax ROS (%)	5.2	5.4	4.1	4.4	1.2
Cash flow ($000)	58	100	101	179	10

E. Summary

Assessing the financial profiles of large segments of the seafood processing industry is indeed complex. Wide variations in profitability levels are present and stem from variations in plant, regions and product and process form. Most of the data was developed in the initial report, however, additional time was spent revising and extending this data. The limited time allocated to the revisions was spent refining profitability estimates, i.e., return on sales, for the respective segments without totally reconstructing complete financial profiles. This was done to expedite the use of the return on sales framework of analysis. The result of the additional effort was to expand or broaden the original profitability ranges for most segments.

The revised profitability ranges presented below were applied to NMFS sales data on a plant by plant basis.

West Coast Model Seafood Plant
Plant No. 1

	Total plant Investment	77% Shrimp		23% Bottom Fish	
		Per lb.	Total	Per lb.	Total
1972 Production - lbs.			1,214,300		357,100
1972 Utilization - %			90%		70%
Sales		1.40	1,700,000	.87	310,700
Product Related Expenses					
Raw product					
Processing labor		1.22	1,481,400	.74	264,211
Pkg. freeze, etc.					
Plant Related Expenses			119,000		32,000
Sales less cash expenses			99,600		14,489
Depreciation			36,200		12,500
Interest (long-term)			33,168		5,880
Net			30,232		-3,891
Investment					
Bldg. & land	1,520,000		1,360,000		160,000
Equipment	107,000		22,000		85,000
ROI before taxes			2.2%		-1.6%
ROS before taxes			1.8%		-1.3%
Weighted plant ROI				1.3%	
Weighted plant ROS				1.1%	

West Coast Model Plant
Plant No. 2

	Plant Investment	85% Shrimp		15% Bottom Fish	
		Per lb.	Total	Per lb.	Total
1972 Production - lbs.			527,000		155,200
1972 Utilization - %			90%		50%
Sales		1.40	738,000	.87	135,000
Product Related Expenses					
Raw production		1.23	648,300	.75	116,300
Processing labor					
Pkg., freeze, etc.					
Plant Related Expenses			68,000		15,000
Sales less cash expenses			21,700		3,700
Depreciation			4,300		4,137
Interest (long-term)			3,480		1,452
Net			13,920		-1,889
Investment					
Bldg. & land			136,000		25,500
Equipment			9,000		35,000
ROI before taxes					
ROS before taxes					
Weighted plant ROI					
Weighted plant ROS					

West Coast Model Plant
Plant No. 3

	Total plant Investment	85% Shrimp Per lb.	85% Shrimp Total	15% Crab Per lb.	15% Crab Total
1972 Production - lbs.			164,000		24,100
1972 Utilization - %			80%		30%
Sales		1.40	229,600	1.68	40,500
Product Related Expenses					
Raw product					
Processing labor		1.21	198,400	1.26	23,800
Pkg., freeze, etc.					
Plant Related Expenses			29,700		8,150
Sales less cash expenses			1,500		8,550
Depreciation			2,000		1,000
Interest (long-term)			1,500		400
Net			-2,000		7,150
Investment					
Bldg. & land	65,000		55,250		9,750
Equipment	14,000		6,000		8,000
ROI before taxes			-3.3%		40.3%
ROS before taxes			-.9%		17.7%
Weighted plant ROI				3.6%	
Weighted plant ROS				0.02%	

West Coast Model Plant
Plant No. 4

	Total plant Investment	50% Shrimp		50% Crab	
		Per lb.	Total	Per lb.	Total
1972 Production - lbs.			178,600		148,800
1972 Utilization - %			80%		30%
Sales		1.40	250,000	1.68	250,000
Product Related Expenses					
Raw product		1.21	216,100	1.26	187,500
Processing labor					
Pkg., freeze, etc.					
Plant related expenses			31,000		33,000
Sales less cash expenses			2,900		29,500
Depreciation			2,475		3,375
Interest (long-term)			1,944		2,160
Net			-1,519		23,965
Investment					
Bldg. & land	150,000		75,000		75,000
Equipment	21,000		6,000		15,000
ROI before taxes			-1.8%		26.6%
ROS before taxes			-0.6%		9.6%
Weighted plant ROI				12.4%	
We ighted plant TOS				4.5%	

West Coast Model Plant
Plant No. 5

	Total plant	10%		90%	
		Shrimp		Crab	
	Investment	Per lb.	Total	Per lb.	Total
1972 Production - lbs.			55,000		412,500
1972 Utilization - %			50%		50%
Sales		1.40	77,000	1.68	693,000
Product related expenses					
Raw product					
Processing labor		1.23	67,600	1.24	511,500
Pkg., freeze, etc.					
Plant Related Expenses			7,700	.18	72,300
Sales less Cash expenses			1,700		109,200
Depreciation			925		7,825
Interest (long-term)			528		4,632
Net			247		96,743
Investment					
Bldg. & land	170,000		17,000		153,000
Equipment	45,000		5,000		40,000
ROI before taxes			1.1%		50.1%
ROS before taxes			0.3%		14.0%
Weighted plant ROI				45.2%	
Weighted plant ROS				12.6%	

West Coast Model Plant
Plant No. 6

		88% Crab		12% Bottom Fish	
	Total Plant Investment	Per lb.	Total	Per lb.	Total
1972 Production - lbs.			108,800		14,500
1972 Utilization - %			60%		50%
Sales		1.68	182,700	.87	12,600
Product Related Expenses					
Raw production					
Processing labor		1.27	118,700	.80	11,500
Pkg., freeze, etc.					
Plant Related Expenses			34,800		2,400
Sales less cash expenses			29,200		-1,300
Depreciation			2,805		2,090
Interest (long-term)			1,613		566
Net			24,782		-3,956
Investment					
Bldg. & land	55,800		52,200		3,600
Equipment	35,000		15,000		20,000
ROI before taxes			36.9%		-16.7%
ROS before taxes			13.6%		-31.4%
Weighted plant ROI				23%	
Weighted plant ROS				11%	

West Coast Model Plant
Plant No. 7

	Total plant Investment	30% Shrimp		30% Crab		40% Bottom Fish	
		Per lb.	Total	Per lb.	Total	Per lb.	Total
1972 Production - lbs.			278,600		232,000		597,700
1972 Utilization - %			70%		50%		70%
Sales		1.40	390,000	1.68	390,000	.87	520,000
Product Related Expenses							
Raw Product		1.23	342,700	1.24	287,600	.74	442,100
Processing labor							
Pkg., freeze, etc.							
Plant Related Expenses			45,000		45,000		60,000
Sales less cash expenses			2,300		57,400		17,900
Depreciation			8,400		9,600		18,200
Interest (long-term)			7,400		7,700		11,568
Net			-13,500		40,100		-11,868
Investment							
Bldg. & land	1,000,000		300,000		300,000		400,000
Equipment	112,000		9,000		21,000		82,000
ROI before taxes			-4.4%		12.5%		-2.5%
ROS before taxes			-3.5%		10.3%		-2.3%
Weighted plant ROI				1.4%			
Weighted plant ROS				1.1%			

West Coast Model Plant
Plant No. 8

	Total plant Investment	30% Shrimp		30% Crab		40% Salmon	
		Per lb.	Total	Per lb.	Total	Per lb.	Total
1972 Production - lbs.			143,500		119,600		157,600
1972 Utilization - %			50%		50%		60%
Sales		1.40	201,000	1.68	201,000	1.70	268,000
Product Related Expenses Raw product Processing labor Pkg., freeze, etc.		1.23	176,300	1.27	140,400	1.42	232,800
Plant Related Expenses			24,000	.20	24,000		29,000
Sales less cash expenses			700		36,600		6,200
Depreciation			1,800		2,700		1,800
Interest (long-term)			1,300		1,500		1,600
Net			-2,400		32,400		2,800
Investment							
Bldg. & land	160,000		48,000		48,000		64,000
Equipment	23,100		6,000		15,000		2,100
ROI before taxes			4.4%		51.4%		4.2%
ROS before taxes			1.2%		16.1%		1.0%
Weighted plant ROI				15.8%			
Weighted plant ROS				4.9%			

West Coast Model Plant
Plant No. 9

	Total plant Investment	15% Shrimp		15% Crab		70% Bottom Fish	
		Per lb.	Total	Per lb.	Total	Per lb.	Total
1972 Production - lbs.			97,500		81,200		732,000
1972 Utilization - %			70%		50%		80%
Sales		1.40	136,500	1.68	136,500	.87	637,000
Product Related Expenses							
Raw Product							
Processing labor		1.22	118,900	1.28	87,800	.73	534,300
Pkg., freeze, etc.							
Plant Related Expenses			14,250	.18	14,250	.09	66,500
Sales less cash expenses			3,350		34,450		36,200
Depreciation			1,201		2,001		13,000
Interest (long-term)			769		985		5,500
Net			1,380		31,464		17,700
Investment							
Bldg. & land	187,000		28,050		28,050		130,900
Equipment	116,000		5,000		13,000		98,000
ROI before taxes			4.1%		76.7%		7.7%
ROS before taxes			1.0%		23.1%		2.8%
Weighted plant ROI				17.5%			
Weighted plant ROS				5.6%			

IV. ECONOMIC IMPACT METHODOLOGY

A variety of methods and analytical procedures have been utilized to assess the economic impacts of effluent limitation guidelines. Discounted cash flow, breakeven analysis and other procedures have been applied to the problem. While a number of techniques have been used, they all have a common objective, i.e., ascertaining the extent to which firms are financially impacted by the imposition of mandatory regulations.

Conceptually (in the absence of data constraints) all methods would produce identical results. Realistically, however, data availability is a requisite consideration in selecting the methodology to be employed.

In the case of seafood processing, a significant amount of data has recently been transmitted to DPRA which has been used to supplement existing data banks. This data contains quantity and sales data for virtually all primary seafood processors. The availability of this data has several implications. These are as follows:

1. An accurate listing of all seafood processing plants--exclusive of duplication--is now available.
2. Primary processors can be separated from producers of specialty items.
3. It is further possible to accurately classify or delineate all plants in the industry on the basis of various characteristics including sales and quantity of specific product produced.

In summary, it is now possible to deal with selected individual characteristics of all seafood processing plants. As a direct result, DPRA has altered the methodology that was previously used. The discounted cash flow analysis has been replaced with return on sales analysis since we can now deal with all plants individually. The profitability measures (estimated in the original report supplemented by additional data) have, however, been used in assessing the severity of the impacts.

A. Fundamental Methodology

The impact methodology consist of five basic parts. A description of each separate step is present below.

1. Industry Segmentation

Industry segmentation is now much more refined and detailed as a result of the above mentioned data. First, the analysis is limited to primary seafood processors. Secondly, the data facilitates delineating the industry on the basis of major commodities produced.

As discussed in Chapter I we have considered only those plants that meet the 80 percent criteria, i.e., greater than 80 percent production (on the basis of sales) of crab, tuna, catfish or shrimp.

This second item, i.e., 80 percent criteria, greatly reduces the multi-product or multi-specie problem encountered. Since the effluent guidelines are written on a specie by specie basis and different technologies are required for different species, some specialization criteria is required. It must be recognized, however, effluent limitation guidelines will eventually cover all species and all plants--multispecie and single specie plants. We further recognize that the above 80 percent specialization criteria in some respects simply forestalls the difficulties associated with applying single specie guidelines to multispecie plants until a later date.

In addition to the above items, the quantity data has facilitated a more refined size classification of plants considered. Annual production data, length of operating season as provided in the Development Document and other peak production data provided by EPA (Effluent Guideline Division) permits classifying all plants on the basis of estimated capacity in tons per day (raw product basis).

2. Pollution Abatement Cost Conversion

The second major step involves converting and scaling the pollution abatement cost estimates received from EPA. This includes ascertaining the correct costs to be applied to the different size plants. These costs include capital, operating and maintenance and monitoring costs. All costs are converted or expressed on an annualized basis. This includes all expenditures required for principal and interest payments on required capital over a ten year period at eight percent interest. These costs (annualized capital industry debt service, operating and maintenance and monitoring) are then totaled to arrive at a total annualized cost for each level of treatment for each plant.

The above costs do not, however, include land acquisition costs for those treatment technologies that require land.

At the time of the intital draft of this document eight percent cost of borrowed capital was realistic. Persistent inflationary trends and recent high interest rates tend to make the initial capital costs and borrowing costs rather conservative. Continued inflation and high interest rates between now and 1977 could result in substantially higher production and effluent treatment costs. Increases in final product prices and technology advances may offset some of the potential effluent treatment cost increases. At the present time, however, no one can accurately project 1977 price levels.

3. Preliminary Impacts

Preliminary impacts have been computed by expressing total annualized cost of pollution abatement as a percent of sales. This calculation provides only a rough estimate of the magnitude of the required expenditures (annualized) relative to total plant sales.

4. Price Effects

Estimating possible price effects induced by pollution abatement standards is the next major step in the analysis. This is perhaps the most difficult and unsettled step in the entire analysis. The reasons are many but in general relate to difficulties associated with estimating the influences of substitution, product elasiicity and many other variables and in some cases, unknown factors.

DPRA has reviewed most EPA industrial development documents, participated in the preparation of others, and reviewed most of the literature on possible price effects induced by pollution abatement standards. For some commodities and/or industries, it has been assumed that all costs are passed forward or backward. In other situations all cost increases are shared by producer, wholesaler or supplier on some basis. Other examples have been uncovered where the price pass through is estimated to be greater than the actual pollution abatement costs incurred, thereby increasing processor margins.

Accurately estimating the price effects depends on many factors. Some of these considerations are as follows:

1. Price elasticity of demand
2. Expected demand growth
3. Market share distribution
4. Competitive structure of the industry
5. Number of producers
6. Captive usage

7. Foreign competition
8. Municipal sewer availability
9. Cooperative waste treatment possibilities
10. Other low cost waste treatment options
11. Production diversification
12. Plant capacity utilization

There is some implicit duplication in the above list, i.e., captive usage and substitutability may express their influence in the form of price elasticity of demand.

A few selected examples will adequately illustrate the complexities involved in projecting price effects. For example, there are no doubt situations where large producers dominating local markets also have access to low cost waste treatment options or are currently utilizing municipal waste treatment systems. Small producers that find it necessary to finance their own private treatment system at higher costs may therefore be constrained from passing on all or any added production costs incurred as a result of effluent limitation guidelines. Alternatively, some producers are able to spread waste treatment costs over a large number of products and thereby achieve lower per unit waste treatment costs which will create greater inequities in required waste treatment costs and total product production costs.

Other producers or perhaps entire regions may gain or already possess favorable competitive positions due to geographical proximity to markets, raw product or with respect to land suitable for low cost waste water disposal. Segments that do not possess these advantages will have difficulty passing on higher pollution abatement costs and still compete with low cost producing segments or areas.

Price increases may be further restrained by low cost foreign producers, e.g., foreign producers that are not subject to EPA regulations and therefore effluent treatment costs.

To further complicate matters, economists have not been overly successful and a concerted effort has not been focused on quantifying elasticity and cross elasticity measures. While some work has been done in this area, the results as of this time are too general to be useful.

A few of these considerations are further summarized in Tables IV-1 through IV-4 which present and explain a few selected factors that can influence possible price increases.

In summary, DPRA feels that the most important factors influencing possible price increases include the structure of the industry, the strength of product demand, demand for substitute and complementary products, magnitude of impacts and industry abatement cost differences. At this point in time, quantitative estimates of these factors are simply not available and are not likely to be in the near future.

Table IV-1. Factors influencing price increases -- Catfish

Factor	Conditions for Constraint	Explanation
1. Substitute Product	High	Acceptable substitute will restrain prices. Competition from other seafood products, i.e., foreign and domestically produced fresh and frozen fish, limits possible price increases.
2. Capacity Utilization	Low	General excess capacity within the industry will prevent selected segments or plants from increasing prices and maintain their present share of the market. In recent years, catfish processing plants have been operating from 40 to 60 percent of capacity.
3. Captive Usage	Low	While the acceptance of catfish varies by area, the product is relatively new and does not possess a large captive market.
4. Foreign competition	High	See description for items 1 and 3 above.
5. Demand Growth	Low	DPRA does not foresee an unusually rapid growth in demand--absolute or relative--which would permit large price increases.

Table IV-2. Factors influencing price increases -- Crab

Factors	Conditions for Constraint	Explanation
1. Substitute Products	High	Various species of crab and shrimp compete in the market place and are considered interchangeable products to many consumers.
2. Capacity Utilization	Low	Plant capacity is typically under utilized due to the lack of pickers or product availability.
3. Number of Producers	Many	The existence of a large number of producers reduces the ability of any one to pass on large price increases.
4. Market Share Distribution	Fragmented	A fragmented local market restrains price increases.
5. Abatement Cost Differences	Unequal	Pollution abatement cost differences will restrain price increases. Large producers with low per unit treatment costs will enjoy a competitive advantage over segments incurring higher per unit treatment costs.

Table IV-3. Factors influencing price increases -- Shrimp

Factor	Conditions for Constraint	Explanation
1. Substitute Products	High	One type of shrimp, i.e., southern versus northern or west coast as opposed to Alaskan, are potential substitutes. Recent public preference for smaller shrimp is in part explained by price increases of larger shrimp. This interrelationship or existence of potential substitute products prevents or restrains price increases.
2. Number of Producers	Many	A large number of independent producers and a fragmented industry prevents or restrains price increases.
3. Foreign Competition	High	Imports of shrimp in various forms or processing stages will restrain possible price increases.

Table IV-4. Factors influencing price increases -- Tuna

Factor	Conditions for Constraint	Explanation
1. Industry Structure	Fragmented fewer large segments.	The tuna processing industry has fewer large producers than most processing segments. This in itself, however, does not insure the ability to pass on all incremental cost of effluent guidelines.
2. Abatement Cost Differences	Unequal	Substantial differences in pollution abatement costs are expected. Older plants may incur substantially greater costs than newer facilites. Several plants have already made substantial investment in pollution abatement equipment and already have the required BPT investment "in place."

The dilemma encountered is that price effects must be considered before closures are estimated. Simultaneity is also encountered in that closures influence industry capacity utilization and therefore price effects and on the other hand industry capacity utilization influences price effects and therefore potential closures.

The assumption that has been adopted for this report is that the price effects are assumed approximately equal to the pollution abatement costs incurred by the largest producer which is viewed as the constraining factor. In some cases where several large plants are clustered together, a weighted average was used to ascertain price effects. Another exception is the price assumption that has been used for catfish. Due to the fact that catfish is a relatively new product with many close substitutes , it has been assumed the catfish processors cannot pass forward or backward any of the pollution abatement costs incurred.

The exact price pass through estimate, by segment is presented in the impact analysis--Chapter VI.

5. Estimated Impacts

The final step or procedure is that of estimating the number of plants that will not be able to withstand the net (after price increases) impacts of pollution abatement standards. This is accomplished by relating profitability levels before the imposition of controls with profitability estimates after imposing controls.

This step involves considerable judgment in that many quantitative factors must be considered. Some of these items are:

1. Salvage value of the plant
2. Book value of plant
3. Alternative employment options available to owners and managers
4. Age of plants
5. Consideration of other constraints such as impending action by OSHA, FDA
6. Factors such as labor availability, expected industry trends, alternative seasonal or part-time employment, land availability, required modernization, and age of owner also influences potential closure decisions.
7. Capital acquiring ability

Community impacts, employment effects and balance of trade impacts can be explored after plant closures have been estimated.

The decision to close a plant seldom depends on only one factor. It is desirable to net out all factors and consider each influence separately. The complication encountered is that by doing so the sum of the parts do not necessarily equal the total. For example, the influence of OSHA, FDA, NMFS, lack of available labor and required modernization may not be sufficiently important to classify a plant as a potential closure when considered separately. When considered jointly, however, the total impact of these factors may be catastrophic. On the other hand it is not realistic to assume that all production cost increases are a direct result of effluent guidelines.

An additional complication is that it is difficult to define "acceptable" profit levels. At what point or how low do profits have to dip until they are no longer acceptable. This obviously varies by individual operator or owner and is influenced by other employment options available. It is relatively easy to locate seafood processors that are not realizing what may be considered by many to be sufficient returns based on the risk and uncertainty associated with the seafood processing industry. In other cases it must be realized that the owner's labor is often included in normal production costs and the profit remaining must be viewed as a residual over and above payments to family labor.

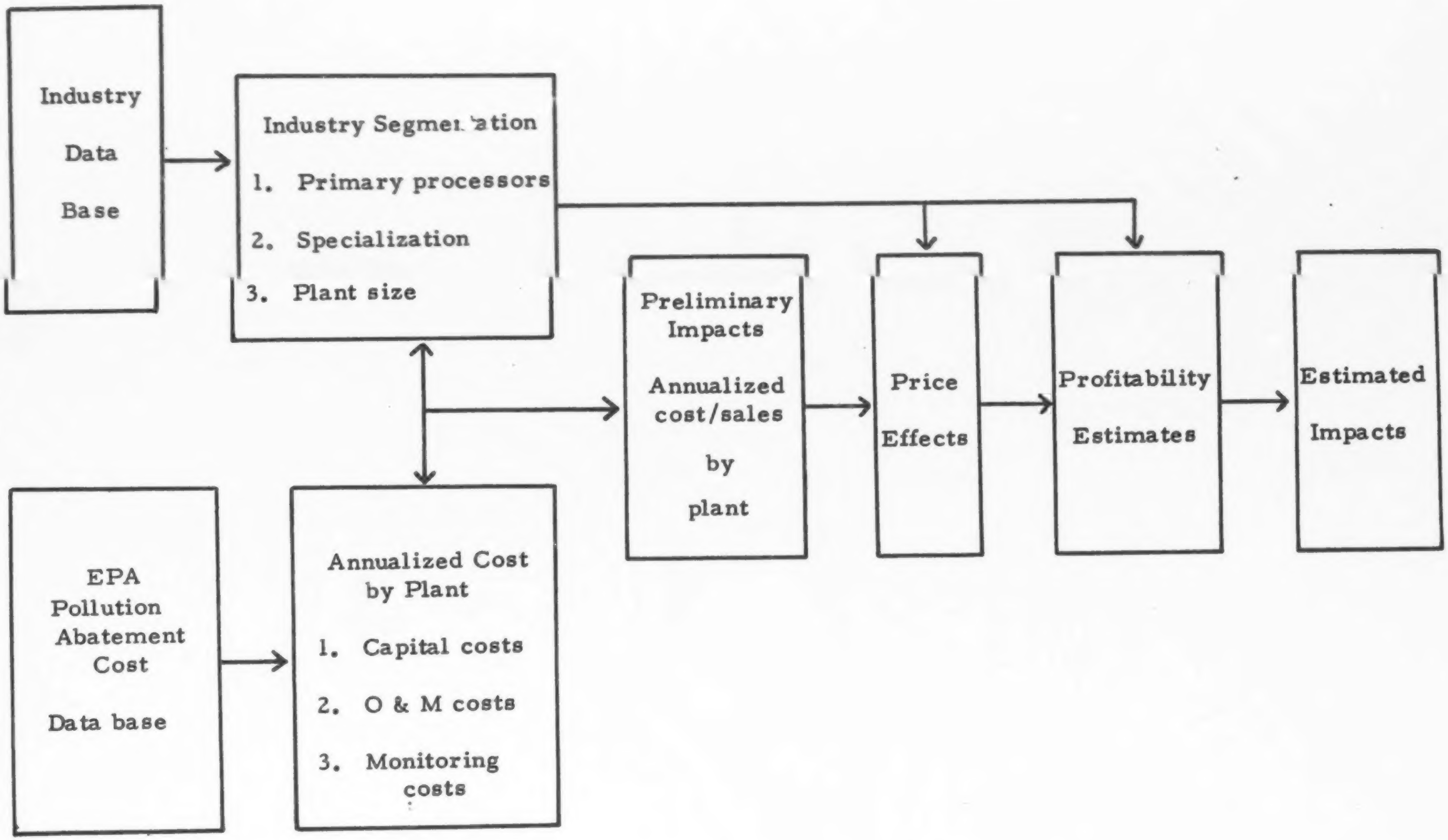
The large number of old, small and run-down processing plants may be viewed as the result of poor profitability and not necessarily the cause of poor financial performance.

In other words, many factors influence the closure decision of plants and not all of these factors can be conveniently expressed in quantitative terms. Judgment, by necessity, must enter the analysis.

Insofar as possible, the estimated number of plant closures is based on only the impacts of pollution abatement standards. All other influences are not considered in estimating the number of plant closures.

A schematic presentation or recapitulation of the above methodology is presented in **Figure IV-1.**

Figure IV-1. Impact methodology -- Summary


Industry Data Base
Industry Segmentation
1. Primary processors
2. Specialization
3. Plant size
EPA Pollution Abatement Cost Data base
Annualized Cost by Plant
1. Capital costs
2. O & M costs
3. Monitoring costs
Preliminary Impacts Annualized cost/sales by plant
Price Effects
Profitability Estimates
Estimated Impacts

V. EFFLUENT CONTROL COSTS

Water pollution control costs used in this analysis were furnished by the Effluent Guidelines Division of the Environmental Protection Agency. These basic data were adapted to the types and sizes of plants specified in this analysis.

Three effluent control levels were considered:

BPT - Best Practicable Control Technology Currently Available, to be achieved by July 1, 1977

BAT - Best Available Control Technology Economically Achievable, to be achieved by July 1, 1983.

NSPS - New Source Performance Standards, apply to any source for which construction starts after the publication of the standards.

A. Description of Effluent Control Levels and Costs

The technical document describing the recommended technology for achieving the BPT, BAT and NSPS guidelines was prepared for EPA by Environmental Associates, Inc. of Corvallis, Oregon and is titled "Development Document for Effluent Limitation Guidelines and Standards of Performance--Canned and Preserved Fish and Seafoods Processing Industry," June, 1974. To avoid duplication and possible confusion, no detailed, technical descriptions of BPT, BAT and NSPS guidelines are given in this report. The interested reader is referred to the above-mentioned document for technology descriptions.

The proposed technologies, capital and operating costs, furnished by EPA for use in this analysis are shown in Table V-1.

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Table V-1. Effluent control costs, seafood processing plants,

Product category	Plant size category	Proposed effluent treatment technology		Capita	
				10 TPD	5
Catfish	> 3,000 lbs., liveweight	Level I[2]	Screening	$13,000	$
		Level II	Screening, aerated lagoon	71,300	4
				12 TPD	8
Conventional blue crab	> 3,000 lbs., liveweight	Level I	Screening	5,860	
		Level II	Screening, aerated lagoon	9,100	
				24 TPD	12
Mechanized blue crab	No size cut-off specified	Level I	Screening	8,900	
		Level II	Screening, aerated lagoon	23,000	1
				15 TPD	6
Dungeness crab, West Coast	No size cut-off specified	Level I	Screening	26,000	1
		Level II	Screening, air flotation	111,000	6
				70 TPD	35
Northern shrimp	> 2,000 lbs., liveweight	Level I	Screening	93,000	6
		Level II	Screening, air flotation	290,000	19
				100 TPD	50
Southern shrimp	> 2,000 lbs., liveweight	Level I	Screening	107,000	7
		Level II	Screening, air flotation	334,000	22

B

nt control costs, seafood processing plants, 1972[1]

effluent treatment hnology	Capital costs[3]			Daily operating and maintenance cost			Monitoring cost per sample[4]
	10 TPD	5 TPD	3 TPD	10 TPD	5 TPD	3 TPD	
Screening	$13,000	$ 8,000	$ 6,000	$ 5	$ 3	$ 2	$28
Screening, aerated lagoon	71,300	47,100	34,600	24	16	11	52
	12 TPD	8 TPD	4 TPD	12 TPD	8 TPD	4 TPD	
Screening	5,860	4,600	3,040	3	2	2	28
Screening, aerated lagoon	9,100	7,100	4,700	9	7	5	52
	24 TPD	12 TPD	6 TPD	24 TPD	12 TPD	6 TPD	
Screening	8,900	5,860	3,800	5	3	2	
Screening, aerated lagoon	23,000	15,200	10,000	14	9	6	52
	15 TPD	6 TPD	2 TPD	15 TPD	6 TPD	2 TPD	
Screening	26,000	15,000	8,000	6	4	2	28
Screening, air flotation	111,000	64,000	33,000	35	20	11	52
	70 TPD	35 TPD	20 TPD	70 TPD	35 TPD	20 TPD	
Screening	93,000	62,000	44,000	11	7	5	28
Screening, air flotation	290,000	192,000	137,000	40	27	19	52
	100 TPD	50 TPD	25 TPD	100 TPD	50 TPD	25 TPD	
Screening	107,000	71,000	47,000	12	8	5	28
Screening, air flotation	334,000	221,000	146,000	46	31	20	52

V-2

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Table V-1. (continued)

Product category	Plant size category	Proposed effluent treatment technology		Capital c	
				22 TPD	8 T
Breaded shrimp	> 2,000 lbs., liveweight	Level I	Screening	104,000	56,
		Level II	Screening, air flotation	328,000	179,
				450 TPD	150 T
Tuna	No size cut-off specified	Level I	Screening, air flotation	470,800	243,
		Level II	Screening, air flotation, activated sludge	1,653,300	855,
				18 TPD	12 T
Alaskan crab meat Non Remote	No size cut-off specified	Level I	Screening	273,904	214,
		Level II	Air flotation	1,168,000	916,
				50 TPD	22
Alaskan crab meat Remote	No size cut-off specified	Level I	Grinding	178,000	108,
		Level II	Screening	505,000	308,
				44 TPD	20
Alaskan shrimp Non Remote	No size cut-off specified	Level I	Screening	651,681	407,
		Level II	Air flotation	3,307,000	2,061,
				45 TPD	18
Alaskan shrimp Remote	No size cut-off specified	Level I	Grinding	260,000	129,
		Level II	Screening	658,000	381,

1/ Source: Effluent Guidelines Divsion, Environmental Protection Agency, from materials dev costs adjusted to 1972 levels by DPRA by applying appropriate cost adjusting factors. Costs

2/ Level I refers to Best Practicable technology (1977). Level II refers to Best Available Tech

3/ Cost of Level I starting from no control. Does not include land acquisition costs. Plant siz product per day.

4/ Monitoring cost of $28 per sample for screening and $52 for all other technologies have bee times a week at the peak of the season (two weeks) and once a week for the duration of the

Table V-1. (continued)

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sed effluent treatment technology	Capital costs 3/			Daily operating and maintenance cost			Monitoring cost per sample 4/
	22 TPD	8 TPD	2 TPD	22 TPD	8 TPD	2 TPD	
Screening	104,000	56,000	25,000	26	14	16	28
Screening, air flotation	328,000	179,000	78,000	104	56	25	52
	450 TPD	150 TPD	40 TPD	450 TPD	150 TPD	40 TPD	
Screening, air flotation	470,800	243,500	110,200	178	92	42	52
Screening, air flotation, activated sludge	1,653,300	855,000	387,000	547	283	128	52
	18 TPD	12 TPD	8 TPD	18 TPD	12 TPD	8 TPD	
Screening	273,904	214,438	167,586	249	195	153	28
Air flotation	1,168,000	916,000	718,000	372	292	228	52
	50 TPD	22 TPD	9 TPD	50 TPD	22 TPD	9 TPD	
Grinding	178,000	108,000	63,000	61	37	22	28
Screening	505,000	308,500	180,200	459	280	164	28
	44 TPD	20 TPD	10 TPD	44 TPD	20 TPD	10 TPD	
Screening	651,681	407,777	266,770	503	315	206	28
Air flotation	3,307,000	2,061,000	1,360,000	870	542	357	52
	45 TPD	18 TPD	7 TPD	45 TPD	18 TPD	7 TPD	
Grinding	260,000	129,000	73,000	92	54	30	28
Screening	658,000	381,100	216,300	508	294	167	28

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onmental Protection Agency, from materials developed by Environmental Associates, Inc., 1971 pplying appropriate cost adjusting factors. Costs are also scaled to reflect appropriate plant sizes.

gy (1977). Level II refers to Best Available Technology (1983).

Does not include land acquisition costs. Plant size represents estimated peak capacity in tons raw

ening and $52 for all other technologies have been adopted. Each plant is assumed to sample three weeks) and once a week for the duration of the operating season.

Since the publication of the Development Document select changes in treatment strategy and the cost of various strategies have been made by EPA, Effluent Guideline Division. These changes have been incorporated in the pollution control cost data illustrated in Table V-1. All pollution control costs were extrapolated to fit actual plant sizes. Monitoring costs, not included in the Development Document, were added to the pollution costs illustrated in the above table. Further, land acquisition costs for technologies that include land have not been included. Normal land preparation costs for these pollution technologies requiring land were, however, considered and are included in the respective cost estimates.

All effluent control technologies, costs and related plant characteristics to which these costs apply were specified by EPA Effluent Guidelines Division, based on the technical report of Environmental Associates, Inc. All treatment system costs are in terms of 1971 cost levels, and it has therefore been necessary to up-date these to 1972 by the use of appropriate cost inflators, i.e., Index of Sewage Treatment Plant Construction Costs for Investment and the Implicit Price Inflator for GNP for operating costs.

B. Current Status of Effluent Control in the Industry

The availability and usage of municipal wastewater treatment systems will be an important factor influencing potential closures of seafoods processing plants. There are no published sources of information concerning the extent to which seafoods processors utilize municipal sewage systems. For the purposes of this study, estimates were made on the basis of industry contacts and discussions with individuals in industry and government who are knowledgeable concerning conditions in their industry. These estimates are shown in Table V-2. For those plants, located on the water front, which do not have sewer connections, fishery processing wastes are usually returned to the ocean through outlet pipes where tidal action sweeps the waste into the ocean. In some instances, solids are ground before being discharged. In other instances screens are used to remove solids which are then disposed of in land fills or, in a few cases, are processed into animal feeds, pet foods or fertilizer. At the direction of EPA, however, it has been assumed that no waste treatment equipment is currently in place.

Table V-2. Plant capacities, two-shift operation, on which effluent control costs were based 1/

Product and Category	Capacity, tons per day raw product 2/
Catfish	20
Conventional blue crab	15-20
Mechanized blue crab	15-20
Alaskan crab	0
Dungeness crab (Calif., Ore., Wash.)	10
Southern shrimp	15
Breaded shrimp	15
Alaskan shrimp	0
Northern pink shrimp (Calif., Ore., Wash., New England)	10
Tuna	15

While only the costs of "end of pipe" treatment strategies have been considered herein it must be recognized that plants discharging into municipal treatment systems will also be impacted. As a general rule, however, the hook-up and user fees for disposing of liquid wastes into municipal systems are less than privately owned treatment systems. Since the cost of discharging into municipal systems varies from community to community these impacts have not been considered. It should also be brought to the reader's attention that exceptions do exist. Examples can be sited, where the municipal sewer charges are in excess of the total annual cost of privately owned treatment systems. Other examples, can also be sited where seafood processors were prevented from acquiring municipal sewer hook-ups.

VI. IMPACT ANALYSIS

The imposition of effluent controls on the seafood processing industry will have both direct and indirect impacts on the industry, on consumers, on its suppliers and on communities in which plants are located. An analysis was made, for specified effluent control technologies in both quantitative and qualitative terms.

The following types of impacts have been analyzed:

A. Price Effects
B. Financial Effects
C. Production Effects
D. Employment Effects
F. Community Effects
G. Balance-of-Trade

A. Price Effects

As will be seen in the following section of this report, the role of price effects in this analysis is critical. The industry is one with a relatively low value added and low profit margin in relation to sales. A small change in the wholesale price with raw product prices staying constant results in significant changes in industry profits. The converse of this argument is likewise true. Hence, if an increase in processor margins can be expected as a result of mandatory effluent treatment practices, the adverse economic impacts of those controls on the industry will be substantially ameliorated. Given the diversity of industry segments covered in this study, it is best to examine prices on a segment by segment basis.

The extent to which price increases can be passed on depends on many factors. These factors include essentially all demand and supply considerations and were enumerated in Chapter IV. Some of these factors are repeated below.

1. the number of firms in the industry
2. the number of plants with low cost waste treatment options such as municipal sewer
3. the relationship of domestic production relative to imports
4. possible substitution effects
5. the competitive structure of the industry.

The complicating factor encountered is that many of the above items as well as those presented in Chapter IV can not at this time be expressed in quantitative terms.

The competitive nature of the industry, the importance of imports, the large number of small independent plants and the fact that we are dealing with a product that has very limited shelf or freezer life indicates that the industry is not in a position to demand and realize unlimited price increases resulting from effluent guidelines or increased production costs. In some segments products can be retained or stored for some time by the processor only to be subjected to additional discounts by the wholesaler.

In general the industry can be characterized as "price takers". Price levels are determined by the strength of aggregate demand, existing supplies and prices of competitive products. We therefore assume that as a general rule only modest price increases can be passed on to the consumers. Further, we do not expect that exvessel prices will decline as a result of pollution abatement standards. A modest reduction in processor margins can therefore be expected for most seafood processing plants in the short run.

The price increases that are utilized in the analysis are assumed to be approximately equal to the impact of the largest plant within each segment. In some cases where several larger plants cluster at the upper end of the size spectrum a weighted average price increase has been used. In other situations where various segments are in direct competition, i.e., Alaskan crab and West Coast crab, a weighted average between segments has been adopted.

In most segments the largest plant is only slightly impacted by the proposed guidelines, which means that the price increases utilized in the analysis are quite small. It should also be pointed out that the price increase used for the catfish segment is assumed to be zero.

The exact price increase that has been assumed for each segment is presented in the production effects section of this chapter.

B. Financial Effects

Financial profiles for the relevant portions of the seafood processing industry have been presented in Chapter III of this report. Basic industry information and data assimilated during the completion of this segment of the study has revealed that there is a great disparity in profit rates, production practices, prevailing technology and expected future profitability within and between all industry segments.

Attempts to acquire specific plant financial data has also indicated that many plants and entire industry segments are operated on a day to day basis influenced primarily by the availability of raw product. Detailed raw product costs, production and financial data are in many cases considered incidental to raw product availability. Variation in raw product availability and the failure of many plants to accurately account for specific production costs and financial data has, in some cases, thwarted attempts to quantify numerous inter and intra industry relationships. The lack of accurate and applicable financial and production data has necessitated a higher degree of generalization than would be normally desirable. The impacts of pollution abatement standards within segments were developed by using fundamental industry relationships, profitability levels reported by knowledgeable industry representatives, published reports and derived relationships.

Profitability ranges based on the model plants developed, as well as numerous industry contacts are presented in the following section.

As has been frequently stated, the ranges are broad which reflect the diversity of the industry. The financial effects of effluent guidelines are directly related to existing profitability levels existing within each segment.

C. Production Effects

Of real and fundamental interest are the production impacts which the inauguration of BPT and BAT effluent controls may bring out. Of particular interest are potential plant closures. As discussed in Chapter IV, the methodology used is a return on sales framework of analysis. The financial burden of pollution abatement standards were applied to the industry segments to ascertain the financial impacts. Inference regarding closures for each segment was drawn, based on the relationship of annualized pollution abatement costs as related to prevailing profitability levels and sales.

1. Potential Plant Closures Under BPT Assumption

BPT effluent limitation guidelines as presented herein will not seriously impact most seafood processing segments. In most segments the small plants will be impacted more severely than larger plants due to lower profitability levels and higher per unit treatmtnt costs. This has been at least partially corrected by providing cut-off points or levels which exempt small plants from the guidelines.

It should also be recognized that the impacts assessed are applicable to national effluent limitation standards only. No attempt has been made to assess the economic impact associated with more restrictive state effluent limitation standards. States that pass more restrictive standards must recognize that as more sophisticated treatment strategies are required the economic impact may be greatly increased.

Expected price increases, profitability levels and projected plant closures are presented in Table VI-1. All calculations were completed on a plant by plant basis. The results of these calculations were then aggregated into multi-plant groups to prevent divulging individual plant data.

It should be pointed out that base line closures have not been specified. It is, however, expected that post trends will continue through 1977 and 1983 and some small plants (those most severely impacted) will close or discontinue production prior to 1977 or 1983.

Catfish - It has been estimated that 2 small catfish plants will close as a direct result of BPT standards. For the small plants, 1.5 to 6 TPD screening could cost an amount equal to .7 percent of sales. While this may be a significant impact considering a profitability range of -1 to +1 percent, most closures in the near future would have to be attributed to other causes.

It is expected that several plants will close prior to 1977. For example, DPRA was notified of one plant that closed as recently as last June. The major problems facing the catfish processors include environmental considerations but this is not the foremost problem facing the industry.

Dungeness crab - No closures have been projected for the West Coast dungeness crab industry; it is not expected to be severely impacted. Current profitability levels are sufficient to present impacts even without the ameliorating effect of price increases. In addition it is expected that modest price increases will result. Some price spill-over is expected from the more severely impacted Alaskan segments.

Tuna - No plant closures have been projected for the canned tuna industry. The larger plants (greater than 200 TPD) are only slightly impacted. Smaller plants while impacted more heavily are not expected to close as a result of BPT standards.

Southern shrimp - Several small plants are classified as threatened closures. These have a relatively high impact (annualized cost as a percent of sales) with an estimated profitability level of approximately 1 percent.

The situation for breaded shrimp and combination shrimp is similar to that of southern shrimp.

Table VI-1. Number of plants, price effects and BPT impacts by segment

Segment/Size	Number of plants	Estimated pre-control profitability level	Total annualized pollution abatement costs	Assumed price pass through	Net impact (cost as % sales)	Estimated closures attributed to BPT
		(% of ROS before tax)	(% of sales)	(Percent)		
Catfish	(31)					
> 1.5 6 TPD	5	-1 to +1	.73	0	.73	
> 6 11 TPD	4		.58		.58	
> 11 TPD	3		.32		.32	2
Dungeness Crab	(9)					
< .75 TPD	(9) 3	9 or	2.0	1.4	.6	
> .75 3 TPD	3		1.0		No impact	No plant closures
> 3 TPD	3		.53		No impact	
Tuna	(17)					
< 80 TPD	5	1.8	.38	.1	.28	
> 80 150 TPD	4		.25		.15	
> 150 200 TPD	4				.1	No plant closures
> 200 500 TPD	4				.03	
Southern Shrimp	(85)					
> 1 1 TPD	34	1 to 5	.83	.2	.63	
> 10 40 TPD	26		.4		.2	1 or 2 small plants threatened
> 40 TPD	8		.25		.05	
Breaded Shrimp	(11)					
> 1 10 TPD	5	1 to 5%	.42	.2	.22	1 or 2 small plants threatened
> 10 TPD	4		.23		.02	

continued.....

Table VI-1. Number of plants, price effects and BPT impacts by segment (continued)

Segment/Size	Number of plants	Estimated pre-control profitability level (% of ROS before tax)	Total annualized pollution abatement costs (% of sales)	Assumed price pass through (Percent)	Net impact (cost as % sales)	Estimated closures attributed to BPT
Blue Crab-Conventional	(152)					
> 1.5 5 TPD	58	1 to 2.	.85	.2	.65	3 or 4 small plants threatened
> 5 10 TPD	34		.44		.24	
> 10 TPD	5		.23		.03	
Combo Shrimp	(15)					
> 1 20 TPD	3	1 to 5	.64	.2	.44	1 or 2 small plants threatened
> 20 30 TPD	4		.41		.21	
> 30 75 TPD	4		.3		.1	
> 75 TPD	3		.2		-0-	
Alaskan Shrimp (non-remote)	(9)					
< 20 TPD	2	10 to 12	3.45	1.0	2.45	No projected closures
> 20 30 TPD	5		2.4		1.4	
> 30 TPD	2		1.7		.7	
Alaskan Shrimp (remote)	(21)					
< 10 TPD	9	10 to 12	1.11	1.0	.11	No projected closures
> 10 15 TPD	8		.8		No impact	
> 15 TPD	4					
Alaskan Crab (non-remote)	(19)					
< 10 TPD	11	8 to 10	5.41	1.4	4.01	5 expected closures
> 10 25 TPD	4		3.5		2.1	
> 25 TPD	4		2.45		1.05	

continued.....

Table VI-1. Number of plants, price effects and BPT impacts by segment (continued)

Segment/Size	Number of plants	Estimated pre-control profitability level	Total annualized pollution abatement costs	Assumed price pass through	Net impact (cost as % sales	Estimated closures attributed to BPT
		(% of ROS before tax)	(% of sales)	(Percent)		
Alaskan Crab (remote)	(40)					
< 10 TPD	18	8 to 10	1.71	1.4	.31	No expected closures
> 10 25 TPD	10		.85		No impact	
> 25 TPD	12		.68		No impact	
Northern Shrimp	(19)					
> 1 5 TPD	9	-1 to +2	2.03	1.0	1.03	3 or 4 closures
> 5 15 TPD	3		.69		No impact	
> 15 TPD	4		.52		No impact	

Blue Crab - The gross impact for the largest plants in the blue crab industry is 0.19 percent of sales. This includes all monitoring, operating and maintenance and capital cost as outlined in the previous chapter. It is further estimated that the small plants (approximately 2 TPD) will have a total annual cost of approximately $500 per year (exclusive of monitoring costs). If monitoring costs are added, the net impact for small plants is less than one percent of sales. Profitability estimates, exclusive of family labor and management are estimated to be from 1 to 2 percent of sales before taxes.

These impacts were computed on the basis of 1972 production and effluent control data. The reader is encouraged to review the limits of the analysis --Chapter VII--for other qualifications.

The mechanized segment of the blue crab industry will not experience the same impact in that overall the mechanized plants tend to be somewhat larger. On the basis of the analysis it is not expected that effluent limitation guidelines will close any of the 21 plants that are partially mechanized.

Alaskan shrimp - Due to the higher estimated profitability of the Alaskan shrimp plant (both remote and non remote) no closures have been projected based on the costs provided. BPT standards require screening and/or grinding for the non remote and remote segments respectively, which is not prohibitive if barging facilities (dock, etc.) are available.

Some questions concerning estimated costs and required facilities have been raised by industry. These will be covered in the last chapter of this report.

Alaskan crab - Five Alaskan crab plants are expected to close as a result of BPT standards. These will be small non-remote plants. The same solid waste disposal problems are, however, expected and will be discussed in the last chapter of this report.

Northern shrimp - On the basis of the calculations performed by DPRA it is expected that 3 to 4 northern shrimp plants will close as a result of BPT standards. It must be cautioned, however, that the profitability estimates for the entire northern shrimp segment were based on West Coast plants which were also applied to New England shrimp processors.

D. Employment Effects

1. Distribution of Employment by Plant Size

There is substantial concentration of employment in large firms in the seafoods processing industry. Published data are not available on each industry and product category considered in this study, but industry-wide data from the Census of Manufactures provides an indication of the situation which exists.

In the fresh and frozen packaged fish industry, in 1967, 79 percent of the plants employed less than 50 people and accounted for 29 percent of total employment. At the other end of the scale, 3 percent of the plants employed over 250 people, but had 34 percent of the total number of employees. Details, by plant size are shown in Table VI-2 .

In the canned, cured and preserved seafoods industry, in 1967, 75 percent of the plants employed less than 50 people and accounted for 23 percent of total employment. In the large plant category, 3 percent of the total number of plants employed over 250 people, but had 33 percent of the total number of employees. Details, by plant size, are shown in Table VI-3.

Approximately 91 percent of the total employees in the fresh and frozen fish industry and 89 percent in the canned seafoods industry are production employees.

2. Annual Earnings

Estimated average earnings, for all employees, in fresh and frozen fish plants, in 1973, averaged $5,050 in the 48 states and $7,550 in Alaska. In the canned seafoods industry earnings averaged $6,122 and $9,152 for the two areas. Distribution of earnings, by plant size, is shown in Table VI-4 and VI-5 for 1973.

3. Possibility of Reemployment in New Plants Being Built

Even though the number of seafood processing plants are declining in the aggregate, some of the small plants are being replaced by medium or large plants that benefit from economies to scale or mechanization. In general, however, there appears to be only a limited probability that new plants would be built in the same location so as to absorb idle workers. Small seafood processing plants face substantial disadvantages due to economies to scale in processing and water pollution control.

Table VI-2. Employment in the fresh and frozen packaged fish industry, by size group, 1967[1]

Number of employees per plant	Number of establishments	Number of employees	Average per firm
Less than 10	178	600	3.4
10 - 49	213	5,600	26.3
50 - 99	65	4,500	69.2
100 - 249	25	3,500	140.0
250 - 499	11	3,500	318.0
500 and over	6	3,800	633.0
Total	497	21,400	43.1

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[1] Source: Census of Manufactures, U. S. Department of Commerce.

Table VI-3. Employment in the canned and cured seafood products industry, by size group, 1967[1]

Number of employees per plant	Number of establishments	Number of employees	Average per firm
Less than 10	109	400	3.7
10 - 49	131	3,300	25.2
50 - 99	46	3,300	71.7
100 - 249	26	3,700	142.0
250 - 499	4	1,500	375.0
500 and over	4	3,600	900.0
Total	320	15,800	49.4

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[1] Source: Census of Manufactures, U. S. Department of Commerce.

Table VI-4. Estimated annual earnings per employee, fresh and frozen fish industry, 48 States and Alaska, by size group, 1973[1]

Number of employees	Average earnings[2] 48 States	Alaska
Less than 10	$5,132	$7,672
10 - 49	5,099	7,623
50 - 99	4,760	7,116
100 - 249	4,560	6,817
250 - 499	5,440	8,132
500 and over	5,268	7,876
Average	5,050	7,550

[1] 1967 earnings inflated by changes in wage rates in food manufacturing industry, 1967-1973.

[2] Includes earnings of both production workers and management employees.

Table VI-5. Estimated annual earnings per employee, canned and cured seafoods, 48 States and Alaska, by size group, 1973[1]

Number of employees	Average earnings[2] 48 States	Alaska
Less than 10	$6,300	$ 9,418
10 - 49	6,405	9,575
50 - 99	6,448	9,640
100 - 249	5,148	7,750
250 - 499	4,946	7,394
500 and over	7,078	10,582
Average	6,122	9,152

[1] 1967 earnings inflated by changes in wage rates in food manufacturing industry, 1967-1973.

[2] Includes earnings of both production workers and management employees.

As a result, it is doubtful that these small plants would be replaced since the remaining medium or large plants which might survive could absorb the added volume represented by these small plants.

4. Absorption of Laid-off Employees by Other Plants

Little opportunity would exist for absorption of laid-off employees by other plants in the same area. Although the seafoods industry is geographically dispersed, total employment in the industry has been declining during the past ten years as larger, more-highly-automated plants have been built which require fewer employees per thousand pounds of seafood processed. In addition, many plants operate only on a single-shift basis at less than 100 percent of capacity. The volume represented by these plants could be absorbed by remaining plants without taking on additional employees.

There is the possibility that some plants could increase imports of partially processed raw materials, reorganize their production lines and concentrate on final processing only. To the extent that this occurs, some employees would be retained and the adverse unemployment impacts partially ameliorated. In general, however, this is expected to have a minor influence on unemployment impacts.

5. Secondary Unemployment Effects

The closure of seafood processing plants could result in some unemployment among fishermen who depended on these plants to provide a market for the fish and shellfish which they caught. The implication of the impact of plant closures on fishermen are discussed in more detail in the section dealing with community impacts.

E. Community Effects

The seafoods processing industry is concentrated in coastal communities from Alaska to Florida to Maine. The pond catfish processing industry is concentrated in the Mid-South.

Seafood processing plants are located primarily in small towns and large cities. There are large numbers of small towns scattered up and down the coasts where fishing and seafood processing is the major industry. This is particularly true in Alaska. However, many major freezers and canners are located in major cities such as Seattle, San Francisco, Los Angeles, San Diego, New Orleans, Tampa, Miami, etc.

Distribution of processors by size of community is shown in Table VI-6.

Table VI-6. Distribution of seafood processors by size of city in which located

Size of City	Percentage of total processors		
	Seafood canners[1]	Seafood freezers[1]	Pond catfish processors
(population)	(%)	(%)	(%)
Less than 1,000	27	7	13
1,000 - 4,999	22	22	59
5,000 - 9,999	6	6	13
10,000 - 24,999	7	6	9
25,000 and over	38	59	6
Total	100	100	100

[1] Includes tuna, shrimp and crab processors.

Although the closing of a major canner or freezer reprsents a substantial economic loss to any community, the impact in a major city such as Los Angeles, San Diego or Tampa, would not be as disastrous as would the closing of a much smaller plant in a location such as Kodiak, Alaska (population under 3,000) where processing of fishery products is the primary local industry. There are 13 shellfish processors in Kodiak and unless they can individually or collectively solve their effluent control problems at a cost which will permit them to stay in business, plant closures could destroy the economic base of Kodiak. Although the situation in Kodiak is dramatic because of the concentration of seafood processing at this location and the lack of alternative employment opportunities, the impact of plant closures would be equally severe in large numbers of isolated communities where the landing and processing of fish and shellfish represents a major segment of the local economy.

The catfish processing industry is already in difficulty. Most processors are operating at less than 50 percent of capacity. However, at present the demand for frozen catfish fillets is strong and the low utilization rate is primarily the result of limitations in the supply of fish for processing. However, if as a result of required investments in effluent control systems, these processors cease operations, the impact would be greatest on low income families in the Mid-South where the seasonal labor required by catfish processing provides a welcome supplement to family incomes. Since much of this income is spent in the local community, it would have a direct effect on the level of business activity in affected areas.

Impacts on Suppliers

Closure of seafoods processing plants will have a direct impact on the suppliers of raw fish (fishermen and pond catfish producers). Because of the perishable nature of fish and shellfish and because of the high wastage in processing operations, the seafoods processing industry is supply oriented. This is particularly true of the shellfish and pond catfish industries. If plants close, fishermen and catfish producers will, in many instances, encounter severe problems in finding alternative outlets for their production.

Pond catfish are hauled live in tank trucks to processing plants. Plants are located in areas where there is a concentration of production. If catfish producers are forced to haul their fish greater distances because of nearby plant closures, the increased cost of hauling would result in substantial reductions in producer incomes. The industry is already faced with a shortage of fish for processing and if catfish farmers reduced production in response to lower returns, this problem would become increasingly severe.

A similar situation would exist in the crab fishing industry. Crab are normally landed live and are cooked and cleaned immediately after landing. Although it would be possible to cook and clean crab where landed and then ship chilled carcasses to processing plants for meat extraction and canning or freezing, the transportation costs involved in shipping iced crab, which would be 70-80 percent waste, would add substantially to product cost and would probably be reflected in lower ex-vessel prices. While it would be possible to land crab at other ports, where processing plants would exist, the additional time at sea would reduce production per boat and lower returns to crab fishermen.

Although the market problem would not be as severe for shrimp, fishermen would still be faced with the problem of delivering chilled, heads-off shrimp greater distances to the remaining processors. This would add transportation costs, whether by truck or by boat, would increase product costs and reduce returns to fishermen. As an alternative, shrimp processors might increase their imports of frozen shrimp and rely less on domestic landings. However, increasing world demand for shrimp, particularly in Japan, has resulted in greater competition for shrimp supplies throughout the world.

The closure of tuna processing plants in any given location would have a lesser impact on fishermen than was true for the other products considered in this study. Tuna are normally caught in distant waters. The tuna fleet is at sea for extended periods and delivery of the tuna catch to alternative locations does not constitute as serious a problem as it does to shrimp or crab fishermen.

While it is impossible to investigate community impacts for all possible plant closures, it is possible to present a few generalizations beyond what has been discussed above. Rather than attempting to pinpoint the location of all expected closures, we have briefly investigated the location characteristic by industry segment to provide additional insight into probable community impacts.

F. Impact on Foreign Trade

The impact of plant closures associated with the imposition of effluent guidelines on the fisheries processing industry could result in driving additional processing overseas.

Tuna

The total supply of canned tuna in the United States has increased from 392 million pounds in 1962 to 673 million in 1972, a gain of 72 percent. Approximately 91.6 percent of the total supply was packed in the United States. However, of this total, 63 percent was represented by imports of fresh or frozen tuna purchased from foreign fishermen by U.S. canners. Imports of canned tuna are relatively unimportant and normally account for 4 to 5 percent of the total supply. Canned imports are subject to tariff quotas equivalent to no more than 20 percent of the previous year's domestic pack. Canned imports have varied between 50 and 73 million pounds and in 1972 were 56,513,000 pounds, equal to 8.4 percent of the total U.S. supply. In only one year, 1970, have imports above quota come in (902,000 pounds). The tariff quota system does not limit total imports but provides for a differential duty, quota imports being levied 6 percent ad valorem in 1972 as opposed to 12.5 percent duty on above-quota imports. Japan is the principal supplier of canned tuna imported into the United States. The low level of imports in 1972 was the result of two major factors, FDA detention of large quantities of Japanese product because of problems associated with decomposition and Japanese currency revaluation.

Adverse foreign trade impacts are not expected since substantial plant closures and production impacts have not been projected. In addition, the rising cost of foreign production is reducing the competitive advantage of imported tuna.

Shrimp

Consumption of shrimp in the United States has nearly doubled since 1960. Prices reached record levels in 1972, but demand continued strong. Of the total 1972 supply of 487.5 million pounds (heads-off), 253.1 million, or 52 percent came from imports. Composition of imports, 1964 and 1972, was as follows:

Form imported	Percent of total imports	
	1964	1972
Shell-on headless	72.7	56.8
Peeled, not breaded	19.6	42.1
Peeled, breaded	0.3	0.6
Peeled, canned	1.9	0.5
Not classified	5.5	-
Total	100.0	100.0

These data show a definite swing toward the importation of a higher proportion of processed or partially processed shrimp. In particular, the relative quantity of peeled shrimp imported has more than doubled since 1964. Most of these shrimp enter as heads-off, peeled frozen shrimp in blocks and are thawed, de-veined if necessary, individually quick frozen and packaged in consumer or institutional packages. These shrimp may be frozen raw, cooked or breaded. Although the volume of breaded shrimp imported more than doubled 1964-1972 (from 0.5 million pounds to 1.3 million pounds), the total volume is still only 0.5 percent of total imports. Imports of peeled canned shrimp have remained fairly stable at around 2.5 to 3.5 million pounds.

Mexico is the most important source of shrimp imported into the United States, supplying 80.7 million pounds (36 percent of total imports) in 1972. Central American countries shipped 33.5 million pounds to the U.S., South America -- 43.9 million, and India -- 33.5 million.

Closure of U.S. shrimp processors as the result of the imposition of effluent limitations would accelerate the existing trend towards increased processing (peeling and de-veining) of shrimp either on board ships or in land-based processing plants located outside the United States. Shrimp landed by U.S. vessels would continue to be processed by those U.S. firms which would remain in operation.

Given the expected maintenance of a strong demand for shrimp in the United States, normal yields from U.S. shrimp fisheries and the low number of expected closures, the total volume of shrimp imports is not expected to change materially from that which would have existed otherwise. The trend toward the importation of an increasing proportion of peeled and de-veined shrimp may be expected to continue due to labor cost differentials.

Crab

In contrast to tuna and shrimp, imports of crab for processing in the United States have been relatively small. Most crabs are landed live and cooked immediately prior to processing. Imports of Blue crabs to the East Coast are negligible. However, imports of West Coast crabs (King, Snow and Dungeness) have increased rapidly since 1967. In 1967 imports were only 1.3 million pounds. Imports jumped to 8.6 million pounds in 1968 and in 1971 were 17.6 million pounds. Most of the imported crabmeat comes from the Canadian Northwest. Imports of canned crabmeat (mainly from Japan) have decreased during the past ten years, from a high of 5.3 million pounds in 1963 and were 2.5 million pounds in 1972, which was, however, equal to 51 percent of the total U.S. supply of canned crabmeat. The U.S. pack of canned crabmeat has also declined, from 11 million pounds in 1966 to 2.4 million in 1972.

It is doubtful that closure of U.S. crab canners would result in substantial increases in canned crab imports. The demand for canned crab is small and has been decreasing. However, should crab freezers in Alaska, Washington, Oregon and California be forced out by effluent guideline requirements, it is probable that, in the absence of equivalent effluent controls by Canada, expansion of crab processing on the West Coast of Canada could occur with the bulk of the crabmeat destined for export to the United States.

Catfish - Imports of wild catfish from Brazil and Mexico compete directly with farm-raised catfish. Production losses emanating from pollution abatement standards could result in additional increases in imports. The total quantity of these imports is, however, relatively small.

G. Summary of BPT Impacts

The above sections briefly describe potential employment, community and balance of payment conditions. In view of the limited number of projected closures (as a result of reduced standards), all of these impacts are considered minor. Unique clusterings of small, heavily impacted plants increases the possibility of creating isolated community adverse impacts.

In general, total plant closures attributable to BPT are not sufficiently large to adversely influence total production.

H. Impact of BAT Guidelines

The emphasis of this report has been on BPT effluent standards. Projected plant closures for BAT guidelines are presented in Table VI-7. Most potential plant closures are entitled threatened closures at this point in time. Possible advances in technology, profitability changes and subsequent review of 1983 guidelines reduces the urgency of these projections. The plant closures were computed in the same manner, however, much less emphasis has been devoted to 1983 or BAT impacts.

I. New Source Performance Standards

Additional production costs emanating from environmental regulations reduces expected profits and therefore has the potential for discouraging new plant investment. BPT guidelines require screening or grinding for all segments with the exception of the tuna processing segment. The estimated cost for screening is quite low and is not viewed as a deterrent to new plant investment.

The possible exception includes the Alaskan seafood processing segment. Solid waste disposal problems in the Alaskan segment appear to be substantial and may limit new plant investment. Some uncertainty exists concerning the classification of specific plants as to remote and nonremote which determines whether plants are required to screen or grind.

New plants are under construction or planned in most segments with the exception of the catfish processing segment. In most cases these plants are relatively large plants that are not seriously impacted by pollution abatement regulations.

Table VI-7. Number of plants, price effects and BAT impacts by segment

Segment/Size	Number of plants	Estimated pre-control profitability level (% of ROS)	Total annualized pollution abatement costs (% of sales)	Assumed price pass through (Percent)	Net impact (cost as % sales)	Estimated closures attributed to BAT
Catfish	(31)					
>1.5 <6 TPD	5	-1 to +1	3.58	1.2	2.38	9 plant closures
>6 <11 TPD	4		1.77		.57	
>11 TPD	3		1.51		.31	
Dungeness Crab	(9)					
<.75 TPD	3	9 or >	6.03	4	2.03	2 plant closures
>.75 <3 TPD	3		3.53		No impact	
>3 TPD	3		2.07		No impact	
Tuna	(17)					
<80 TPD	5	1.8	1.26	.5	.76	3 threatened plant closures
>80 <150 TPD	4		.83		.33	
>150 <200 TPD	4		.7		.2	
>200 <500 TPD	4		.5		-0-	
Southern Shrimp	(85)					
>1 <10 TPD	34	1 to 5	2.35	.5	1.81	9 - 10 threatened plant closures
>10 <40 TPD	26		1.22		.68	
>40 TPD	8		.77		.23	
Breaded Shrimp	(11)					
>1 <10 TPD	5	1 to 5	1.33	.5	.65	
>10 TPD	4		.76		.08	

Continued....

Table VI- 7. Number of plants, price effects and BAT impacts by segment (continued)

Segment/Size	Number of plants	Estimated pre-control profitability level (% of ROS)	Total annualized pollution abatement costs (% of sales)	Assumed price pass through (Percent)	Net impact (cost as % sales)	Estimated closures attributed to BAT
Blue Crab - Conventional	(152)					
>1.5 <5 TPD	58	1 to 2.4	1.62	.5	1.12	2 threatened plant closures
>5 <10 TPD	34		.84		.34	
>10 TPD	5		.45		No impact	
Combo Shrimp	(14)					
>1 <20 TPD	3	1 to 5	2.04	.5	1.36	2 threatened plant closures
>20 <30 TPD	4		1.33		.65	
>30 <75 TPD	4		1.63		.95	
>75 TPD	3		.66		No impact	
Alaskan Shrimp (non-remote)	(9)					
<20 TPD	2	10 to 12	11.8	4.0	7.8	10 threatened plant closures
>20 <30 TPD	5		8.36		4.36	
>30 TPD	2		5.95		1.95	
Alaskan Shrimp (remote)	(21)					
<10 TPD	9	10 to 12	3.45	4.0	No impact	6 threatened plant closures
>10 <15 TPD	8		2.4		No impact	
>15 TPD	4		1.7		No impact	
Alaskan Crab (non-remote)	(19)					
<10 TPD	11	8 to 10	16.56	4.0	12.56	6 threatened plant closures
>10 <25 TPD	4		11.4		7.4	
>25 TPD	4		8.18		4.18	

continued.....

Table VI- 7. Number of plants, price effects and BAT impacts by segment (continued)

Segment/Size	Number of plants	Estimated pre-control profitability level (% of ROS)	Total annualized pollution abatement costs (% of sales)	Assumed price pass through (Percent)	Net impact (cost as % sales)	Estimated closures attributed to BAT
Alaskan Crab (remote)	(40)					
< 10 TPD	18	8 to 10	5.41	4.0	1.41	4 threatened plant closures
>10 < 25 TPD	10		3.5		No impact	
>25 TPD	12		2.45		No impact	
Northern Shrimp	(19)					
> 1 < 5 TPD	9	-1 to +2	5.74	4.0	1.74	12 threatened plant closures
>5 < 15 TPD	3		2.05		No impact	
>15 TPD	4		1.59		No impact	

VII. LIMITS OF THE ANALYSIS

A. General Accuracy

The seafoods processing industry is complex in terms of the number, ownership, location, type and size of plants. Variations in the seasonal pattern of operations, extreme variation in climatic conditions (Kodiak, Alaska to Key West, Florida) and substantial differences in raw produce characteristics all contribute to the complexity of this industry.

Supplementary data on sales and quantity recently transmitted to DPRA greatly simplifies the analysis and increases the overall accuracy of the report. In addition, considerable time has been spent supplementing original data sources and revising critical assumptions. Even though additional time and effort has been invested, there is still a great deal of unexplained variation from plant to plant. There are very few industries in the U. S. that are more complex in terms of number and type of plants than the seafood processing industry.

Throughout the study, an effort was made to evaluate the data available and to update these materials wherever possible. Checks were made with informed sources in both industry and government to help insure that data were as reliable and representative as possible. In some instances, e.g., catfish data, visits were made to offices of agencies responsible for development of these statistics and access was permitted to unpublished data which was necessary for background purposes or to provide data for recent periods.

Although processing cost data, information on investments and profitability information must be considered approximate, general information on these items was obtained from a substantial number of processors and when classified and cross-checked, showed reasonable degrees of consistency.

Published information from the Internal Revenue Service, such references as Standard and Poors, Dun and Bradstreet, and other sources of data on financial ratios and financial performance were also used as checks on the reasonableness of results obtained in the impact analysis.

While the accuracy of this report has been enhanced by greater cooperation and data availability, the complexity of the problem and data limitations are such that judgment is invariably involved. Whenever judgment is involved, the possibility of error increases.

These errors emanate from a variety of sources. Collectively, they may be additive or offsetting. Some of the major sources of possible error are enumerated below.

1. Effluent Control Costs

Water pollution control costs were furnished by EPA, Effluent Guidelines Division. These costs were developed for a variety of industry categories and subcategories and effluent treatment systems. It was necessary to adapt these effluent control costs to the types and sizes of plants used in this analysis. Whenever it becomes necessary to ascertain estimates of effluent treatment systems for plant sizes other than that provided, the possibility exists that the cost extrapolation technique utilized may not be appropriate. Most extrapolation techniques assume smooth functions when in fact step functions may exist.

2. Current Effluent Treatment Status of the Industry

Assumptions concerning the current effluent treatment status of the industry are also critical to the analysis. In this report, based on the recommendations of the Effluent Guidelines Division, EPA, it was assumed that no treatment is current "in place".

3. Current Status of Municipal Treatment in the Industry

Only limited information is available concerning the number, location and types of seafoods processing plants discharging into municipal sewage systems. As a result, it was necessary to develop estimates of the number of plants served by municipal sewer systems. These estimates were made by personal visits to plants and by telephone contacts with processors and others knowledgeable concerning effluent control practices at specific locations. The estimates are shown in Chapter V. Although these estimates are not based on a complete survey of all of the plants in each area and product category, it is believed that contacts made in each area were adequate to provide a useful estimate of the importance of municipal waste treatment system connections to the seafood processing industry. In some situations, e.g., Astoria, Oregon and Terminal Island, California, expanded and/or improved sewage treatment facilities are either planned or actually under construction. These new facilities will relieve the situation in those locations as they are completed and come on stream.

4. Estimating Peak Capacity

The fourth area of possible error stems from the fact that effluent control costs are or should be based on peak capacity of the plant which must be estimated. In the seafood processing industry, plant capacity is a rather nebulous concept. This stems from the fact that plant capacity may be doubled or expanded greatly by simply adding an additional filleting table.

Peak plant capacity was assumed to be thirty percent greater than average annual production. This assumption was based on the recommendations of the Effluent Guidelines Division, EPA.

5. Economic Status of the Industry

In addition to the above factors there is likely to be a great deal of variation in the economic profiles of individual seafood processing plants. Throughout the report we have estimated profitability by industry segment. These estimates are broad generalizations for the entire segment. The profitability of any one plant may deviate from the industry average by a factor of two or more.

6. "Shutdown" Decisions

The general purpose of the "shutdown" analysis is to examine the profitability of plants before and after the imposition of effluent limitation guidelines, to determine the probability of forced closures which would result and to calculate the price changes required to cover the added effluent control costs. This requires assumptions relative to numerous factors and are described in detail in previous sections of this report. Assumptions used, while arbitrary, were made on the basis of the best information which could be developed regarding conditions prevailing in the seafoods processing industry.

Estimating price effects is still another possible source of error.

7. Inflationary Trends

Another source of concern to industry is the inflationary spiral that has persisted in recent years. 1972 was used as the base year in the analysis.

Continuation of these trends will increase further production, effluent treatment costs and final product prices. The net effect on processor margins can not, however, be determined at this time. Recent communications with blue crab industry representatives indicate that labor payments have increased 25 percent, cans 5 percent and energy cost 80 percent. These increases are of great concern to industry and the reader is advised that these costs have not been reflected in the 1972 data used in the analysis.

B. Other Considerations

While an attempt was made to utilize all data available, there are several other areas and methodological procedures embodied in the report that influence the overall accuracy of this document.

One of these factors stems from the fact that the analysis assumes "end of pipe" treatment. In many areas cooperative treatment, reduction of solids, cooperative barging will substantially reduce the actual effluent treatment cost.

At the direction of EPA it was also assumed that the current effluent treatment status of the industry is near zero. In most segments, however, one can easily locate plants with fairly advanced effluent treatment systems. Since it is assumed that the current treatment status of the industry is less than is actually in place, it appears that the projected closures may be on the high side.

In summary, the above material breifly discusses several factors that would increase or decrease the number of plant closures projected herein. Other factors not discussed could also influence the accuracy of the analysis. In general, however, it is believed that the impacts projected in this report could be represented as the worst or extreme situation and that the actual closures may be fewer in number.

C. Selected Qualifications for Alaskan Segments

There are some indications that the costs of solid waste disposal in Alaska have been seriously underestimated. In addition there are further indications that there are many physical constraints to both barging and/or land fill. These items reappear frequently in the solid waste disposal summary presented below. Land fill and barging constraints exist and are heavily dependent upon local conditions. The following summary is intended as a description of constraint at selected locations.

1. Problems Associated with Land Fill Solids Disposal in Alaska

General - Land fills are governed by State law. In order to obtain and keep a State permit, strict conditions must be met. Land fills must be operated in a sanitary manner in acceptable locations without risk of contamination to state waters by seepage or leakage. Sufficient soil must be available to cover the dumped materials at the end of each day's operation. The operation must not cause any esthetic or ecological damage.

None of the plants listed in the report is presently using a land fill for disposal of seafood processing waste. In some areas the surrounding land is definitely not suitable for land fill. In the other areas where the distance to the site is listed, the site is potential and conditions would have to be further investigated before a final decision could be made.

Bristol Bay - The land area in Bristol Bay is at approximately sea level. It is flat and there are numerous lakes and pot holes. The surface is covered with tundra with underlying permafrost. Land fills in this area would not appear to be workable because of the natural conditions and the fragile nature of the sub-arctic environment.

Kodiak Island - Plants in the City of Kodiak are handling processing solids in a reduction plant and have no need for land fill. Plants on the rest of the island have potential sites but since the island is essentially rock without much top soil there might be a problem in finding enough covering material to comply with State operating regulations.

Cook Inlet - Land filling on the Kenai Peninsula would probably be more successful than in other areas of Alaska. Potential sites are available; however, local conditions would have to be investigated, especially sandy areas, to determine whether the leakage could contaminate State waters. Also muskeg soils would cause problems.

Prince William Sound - Limited area may be possible. Much of the land is mountainous and flat areas are tide flats. These areas would obviously be unsuitable.

Southeastern Alaska - Generally mountainous behind the beach areas where canneries are located. Terrain would make land filling difficult Also, the high annual rainfall might cause problems with leakage entering State waters.

Washington and Oregon - Solids are generally used in reduction plants. Land fill areas are available, however experience with various cities indicates that available sites are rapidly being used up.

2. General Comments on Barging Processing Waste From Seafood Plants

There are a number of critical constraints on barging of solid seafood waste for ocean disposal and they are as follows.

a. It is not clear from applicable state and federal regulations exactly what constitutes proper disposal areas for seafood waste. If such areas are outside of three miles, barging could require round trips in excess of 200 miles such as in Cooks Inlet.

b. In some cases, barging of solid waste would require the construction of new dock facilities, and the purchase of barges and towing equipment. In some areas such as Bristol Bay and Cooks Inlet barges would have to be of shallow draft to operate in the area. In some areas, as in the case of the Whitney-Fidalog plant in Petersburg, Alaska there is no space available to build docking facilities for barges. Docks, barges, and towing equipment would only be used for a period of one to three months. The barges and vessels would have to be stored ashore the remainder of the year. The cost of leasing such equipment during the summer season may be prohibitive.

c. In regions with great tidal movements, such as Cook Inlet and Bristol Bay, barges could only be taken out at high tide and would therefore necessitate extra barges and dock space to handle full barges waiting for ties. The crew expense would be quite high as barges would have to be moved on high tide regardless of the hour of day or night.

d. The general weather conditions would not make it possible to move barges in many cases on any reasonable schedule. Handling barges because of strong tide, heavy seas, and high winds in unprotected areas would be impossible. It is probable that barges could not be towed and dumped in the proper areas 25 to 30 percent of the time because of the weather factor alone.

e. Barges laying at the processing plants which contain processing waste would be an attractant for flies and other insects, birds, and rodents and consequently would create a serious problem in terms of plant sanitation in the view of local, state, and federal health agencies.

3. Consideration of Alternate Plant Sites

The problems associated with moving existing seafood processing plants to other areas to provide for disposal by barging, land fill or municipal treatment are numerous.

The matter of moving a processing plant would still leave the plant subject to all of the constraints on barging and land fill noted previously.

The availability of property is also very difficult because of the importance of remaining near fish producing areas in order to minimize transportation time from the fishing grounds to the plants to help assure wholesome products. The varying seasonality of fishing by districts emphasizes this problem.

The status of land in Alaska is another problem at this time because a number of Native Corporations have not selected their lands under the Native Land Claims Act and because the State of Alaska also has the subsequent right of land selection

There are only a limited number of locations which afford plants adequate processing water, labor force, transportation, and protection of docks and the plant from weather.

Additional considerations are presented in Table VI-2 which briefly ennumerates solid waste disposal constraint for selected plants. Many of these plants are salmon processing plants as well as processors of other fish and shellfish but are included as representative examples of the Alaskan seafood processing industry.

In summary, it appears that there are many technical or physical constraints on solid waste disposal in Alaska. In addition, there is some doubt as to whether the pollution abatement costs adequately reflect the actual costs that may be incurred, i.e., duplicate barges etc. If this is the case then additional plant closures could result from the imposition of BPT guidelines.

The lack of available land, dock and duplicate barge requirements could result in greatly inflated BPT closure estimates.

Table VII-[illegible] Solid waste disposal summary of selected seafood processing plants in Alaska.

Company Name	Plant Location	Potential Miles to Land Fill	Acres Owned by Plant	Ownership of Surrounding Land
		BRISTOL BAY		
Whitney-Fidalgo	Naknek	Land not suitable	3	Local residents
North Pacific Processors	So. Naknek	Land not suitable	6	Local residents & City
Columbia Wards Fisheries	Ekuk	Land not suitable	6	Alaska Native Corporation
Bumble Bee Seafoods	So. Naknek	Land not suitable	5	Local residents No. Pacific Seafoods
New England Fish Co.	Pederson Point	Land not suitable	10	Other business Native Private Ownership
New England Fish Co.	Egegik	Land not suitable	1	Other business City & Private
		KODIAK ISLAND		
Whitney-Fidalgo	Kodiak	5	2	Local residents Peter Pan Seafoods
North Pacific Processors	Kodiak	5	2	Alaska Packers Kodiak Airways
Columbia Wards Fisheries	Alitak	NA	4	Federal Wildlife Reserve
Columbia Wards Fisheries	Port Bailey	NA	6	Private & State Lands
Kodiak King Crab, Inc.	Kodiak	NA	4	City, State, & other processors

NA = Not Available

Table VII-1. (continued)

Company Name	Plant Location	Potential Miles to Land Fill	Acres Owned by Plant	Ownership of Surrounding Land
		KODIAK ISLAND (Cont.)		
Kodiak King Crab, Inc.	Zachar Bay	NA	2	Native Land Claims Act
Kodiak King Crab, Inc.	Port Williams	NA	11	National Forest, Native Land Claims
New England Fish Co.	Uganik	1/4 mile	5	State & Federal
		COOKS INLET		
Whitney-Fidalgo	Anchorage	17	Lease Property	Alaska Railroad
Whitney-Fidalgo	Port Graham	NA	4	Local Alaska Natives
Kenai Packers	Kenai	NA	46	Alaska Packers & Local homesteads
Columbia Wards Fisheries	Kenai	NA	55	Local homesteads
		PRINCE WILLIAM SOUND		
Whitney-Fidalgo	Whittier	NA	Lease Property	Alaska Railroad
North Pacific Processors	Cordova	NA	Lease Property	City of Cordova
St. Elias Ocean Products	Cordova	NA	1	Indian Land Claims
New England Fish Co.	Orca	5 miles	7	Federal
		SOUTHEASTERN ALASKA		
Whitney-Fidalgo	Ketchikan	NA	2	Union Oil Co. Local Metal Shop

Tab[illegible]VII-[illegible] co[illegible]ued

Company Name	Plant Location	Potential Miles to Land Fill	Acres Owned by Plant	Ownership of Surrounding Land
		SOUTHEASTERN ALASKA (cont.)		
Whitney-Fidalgo Seafoods	Petersburg	NA	Plant on piling 100 ft. from shore	U. S.
New England Fish Co.	Chatham	1	None owned - Leased Fed.	Federal
Juneau Cold Storage	Juneau	15 - probably not available	1	City
McCallum Legaz Fish Co.	Hydaburg	NA	Leased	Indian owned
Excursion Inlet Pkg. Co.	Excursion Inlet	NA	6	U. S. Forest Service
Wards Cove Packing Co.	Wards Cove	NA	5	Private land
		WASHINGTON		
New England Fish Co.	LaConner	10	None owned - Leased city	Private
Whitney-Fidalgo	Anacortes	NA	" "	Other business
Whitney-Fidalgo	Seattle	NA	5	Other business
Bumble Bee Seafoods	Bellingham	NA	4	Other business
Perfection Smokery	Seattle	NA-City pickup	1/4	Private
		OREGON		
Bumble Bee Seafoods	Astoria	NA	7	Other business

D. Qualifications for Tuna Processing Segment

It should be recalled that only a single point profitability estimate was included for the entire tuna industry. This was applicable to a relatively large plant. If the profitability rate for small plants is substantially less the impacts contained herein are an understatement of actual impacts for the small plants. The possibility may warrant a size cut of below which air flotation should not be required. It should be recalled, however, that lower profitability estimates were lowered to compensate for this limitation.